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ABSTRACT

Six papers examine innovations and trends in distance learning, frequently drawing upon empirical research or informal observations on distance learning students at Charles Sturt University (Australia). "On-Line Study Packages for Distance Education: Some Considerations of Conceptual Parameters" (Dirk M. R. Spennemann) discusses issues in the design and use of interactive teaching packages on the World Wide Web. "A Hypermedia Teaching/Learning Resource for 'Grape and Wine Production'" (Peter Donnan and others) focuses on a hypermedia program used to teach a class in grape and wine production; it reflects on the program's development and evaluates the utility and possible advantages of CD-ROM over print materials. The remaining papers are largely survey results. "Study Duration of Post-Graduate Distance Education Degrees Offered by Australian Universities" (Dirk M. R. Spennemann and Lesley H. Montfort) studies the duration of the average graduate degree program for Australian distance learning students, in light of emerging debate about the benefits of compressing coursework into shorter, high-intensity programs; "Student Evaluation of 'Concepts of Biology'" (Helen Wood) describes a student survey evaluating a biology course; "The Implementation of Modularisation in Teritary Institutions in Australia" (Sue Davies and Terry Harden) examines the extent to which Australian tertiary institutions have modularized course materials; and "Icons in Teaching Materials--Distraction or Salvation?" (Helen Wood) presents survey results in which students overwhelmingly endorsed the use of icons as visual cues in course materials. (BEW)

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IN OPEN AND DISTANCE LEARNING

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Editorial

Each of the six papers in *Occasional Papers in Open and Distance Learning*, Number 18, can be accessed by using the following address on the WEB browser:
URL: http://www.csu.edu.au/division/OLI/oli-rd/oli-rd.htm

In adopting this form of electronic publishing, the Open Learning Institute will still produce the publication in hardcopy but the distribution list will now change within Charles Sturt University. Sample copies will be sent to each school so that academic staff can peruse the contents of each edition. Personal copies of papers that are of particular relevance can then be printed later. The publication remains essentially a forum for CSU teaching staff to promote innovations and become aware of substantial practice in the areas of open and distance learning. Outside the University, the publication is made available and sold to Australian and overseas institutions that have an interest in this area.

Issue Number 18 of *Occasional Papers in Open and Distance Learning* advances upon themes that have emerged in recent editions. The first two papers focus upon significant technological innovations at CSU: on-line study packages for distance study and the first multimedia subject delivered on CD-ROM . The conceptualisation, development and design of distance subjects delivered in these new computer modes are explored in both papers and there is a sense that distance education practice will be dramatically influenced by technologies which use the World Wide Web and multimedia platforms. CSU is implementing a technology strategy which should see a proliferation of such innovations but it is important that follow-up, evaluative studies accompany this process so that the benefits to learners can be well documented.

Paper three is based on a study contrasting rates of progress through graduate diploma and masters by coursework courses. Paper four focuses on the evaluation of a subject, *Concepts of Biology*, that was offered for the first time in Autumn 1994. Among other factors paper three countenances the idea of a half-term enrolment option to address the study duration patterns identified in the study and the fourth paper demonstrates the value of ongoing evaluation in meeting learners' needs and assuring course quality.

The use of icons in distance learning materials and CSU's experience with modularisation of distance subjects have also been discussed in recent issues and the final two papers expand upon perspectives previously presented. Paper five presents data indicating students' endorsement of the use of icons and the final paper considers how other Australian distance institutions have responded to modularisation.

Peter Donnan
Editor

A call for papers

Occasional Papers in Open and Distance Learning is published twice a year, generally in April and November. As the title suggests, a considerable range of issues is appropriate for inclusion within the publication.

The editor would like to invite papers from CSU staff which focus on open and distance learning.

Please submit a copy of any material for publication in the next issue to:

Peter Donnan
Editor
Occasional Papers in Open and Distance Learning
Charles Sturt University
PO Box 588
Wagga Wagga NSW 2678

Please note that if you are typing your paper the editor can provide an IBM template (Word for Windows) or a printed style guide for contributors using other word processing packages.

Inquiries: **Peter Donnan**
Ph: (069) 33 2338
Fax: (069) 33 2072
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On-line study packages for distance education

Some considerations of conceptual parameters

Dirk H.R. Spennemann
School of Environmental and Information Sciences

Abstract

The recent developments of server-based technology have seen the Internet become more and more pervasive. The 'information superhighway' has been touted far and wide as heralding a new age. Certainly the **W**orld **W**ide **W**eb (WWW) offers a wide range of options for communication and for the exchange of information. Both individual pages of information and information exchange networks have been developed (cf. Green 1994). As a result it has become feasible to offer entire interactive teaching packages on the web.

The key principle of computer-driven interactive multimedia education systems is that the student is enabled to determine his or her own rate of progress through the subject matter and to conduct the self training at self-determined intervals. With the inclusion of pictorial and audio material and the provision of multiple pathways or links the student can effectively steer and navigate a route which will favour that particular student's mode of learning. Unlike text-based materials, however, a computer program cannot easily be taken along on a train or bus or outdoor location. Thus while the mode of study is potentially enhanced, the study environment becomes restricted. The enhancements need to be sufficiently sophisticated to offset the confinements of the study location.

Computerised learning packages

Computer packages have been used in a wide variety of applications, ranging from teaching touch typing (e.g. Type!™) to teaching languages (Yung-Kim Lee 1993) and non-Roman scripts (Ross 1993), biology (Gleadow *et al.* 1993), soil science (Donnan *et al.* 1994), wine production (Donnan *et al.* 1994), chemistry (Mikhelson & Klease 1993), anatomy (*'Adam'* ADAM 1992) and physiology (Coppa and Tancred 1992) and so forth. While some packages are HyperCard-based systems with correct/wrong answers and mixed levels of repetition to achieve mastery of a subject matter (Orton & Grace 1990), not unlike brute-force cramming-style learning approaches, others are complex resources with varied levels of data detail to inform and facilitate inquiry. Others still, such as *'Lake Iluka'* or Model-It (Soloway *et al.* 1995) are full-blown simulations.

In general, the packages can be grouped into four classes (table 1). There is a need for all four types of resources, depending on the particular learning outcome required, and none of these are the 'be-all-and-end-all' of computerised training.

Table 1. Classes of computer-assisted learning packages.

Class	Type	Aim
I	'drill and practice'	mastery of methods/practices
II	'encyclopedia'	information resources for factual knowledge
III	'challenger'	imparting concepts and theory, thus challenging students
IV	'simulation'	application of methods, theory and factual knowledge

Multi-media: saviours or detractants?

Multimedia *per se* do not result in increased learning and do not advance a student's understanding of the subject matter. Rather, the interactive mode of learning is the critical factor involved, as it allows the student to follow up various pathways influencing the individual learning outcome (Clark & Craig 1992).

The traditional university teaching concept entails a situation where the lecturer is in control of the information *and* the learning process in the form of lectures and tutorials. An analysis of teaching a cultural heritage subject in an applied science context has shown that students' migration from surface learning to deep learning is inhibited by a number of parameters, which need to be addressed systematically if the outcomes for the students shall improve:

- comfort thresholds of students to tackle challenging concepts;
- students' ability and preparedness to peruse library resources beyond the immediate need for the completion of assignment (Spennemann 1995).

For the students' learning process we would have to consider the following sequence:

1) Reception of ideas/information
↓
2) Re-formation of ideas integrating own experience
↓
3) Exemplification of ideas integrating own experience
↓
4) Generalisations from ideas
↓
5) Generation of queries derived from ideas
↓
6) Connections of ideas with the discourse

Does it work, though? Internal students tend to exhibit little *a priori* capacity for independent learning. The majority of the students seems to be incapable of taking contextual notes, of transforming material 'on the fly' during lectures and of producing contextually significant notes. It seems, however, that the time interval between the individual lectures allows students' reflections on the issues made during the lecture, and that the 'belabouring' of crucial points (during tutorials or

special lectures), reinforced these messages. In short, the time interval between the lectures allowed for the reformation of ideas received during a lecture.
These ideas were then reinforced by exemplification, both during the lecture and during the case study lecture wrapping up matters discussed earlier. So far, so good.

What is lacking, however, is the ability of the internal students to generalise from these ideas and to connect them back into the discourse. Some blame for this failure needs to be placed at the door of the lecturer. However, the inability or unpreparedness of the students to utilise library resources and to engage in independent learning over and beyond the 'call of duty', i.e. the bare minium to cope with the assignments in an adequate fashion, exacerbates the problem. There appears to be an expectation that the information be 'spoon fed'. At the moment, it seems, the ability to independent inquiry differentiates those few very good students from the bulk of good and mediocre performers. It appears that this ability also coincides with the students' ability to migrate beyond the comfort threshold.

Distance education packages make the approach more user friendly as they permit the student to work through the package at his or her pace. They are basically still linear and in their approach centred on the one-and-only structure the lecturer has provided.

There are clear limitations in the distance education packages we provide to students. The packages contain only what we deem appropriate and necessary. Independent learning, moving from surface understanding to deep learning, implies utilising a students' motivation to develop an ability to venture beyond the minimum requirements into the unlimited realm of published opinion and case studies. Students living in remote locations, such as small national parks, hundreds of kilometres away from city libraries, let alone university libraries, are limited to that very material which is included in the mail package. This material has already been screened for 'suitability', 'appropriateness', etc., and does represent the package author's ideas of what is and what is not relevant or germane to the study subject. Such limitations, however, are not conducive to wide-ranging independent inquiry. Nonetheless the resources thus provided are seen as 'good value': in conversations with students and ex-students I have found that the reading volumes were kept and often served as miniature libraries for a long time (Spennemann 1995).

Technology now allows us to overcome this and to construct teaching media where the learning process and the student are in the centre and all else revolves around it. Moreover, the design can accommodate the differences between students in terms of ability, speed of progress and interest. The pre-packaging of reading materials and the potential limitations imposed on independent inquiry on the road to deep learning, however, does also have implications on the future teaching technology strategy. Whilst it makes browsing a faster process, CD-ROM and on-line technology have the potential of removing students further from unfettered browsing of library holdings of similar Dewey codes to the sources sought in the first place, and thus of increasing a reliance on pre-packaged, and partially already predigested reading and subject matter. Care needs to be taken to provide ample resources of varied quality, to facilitate a students' learning process in discerning

the differences between the resources. The most easily available one is not necessarily the best one.

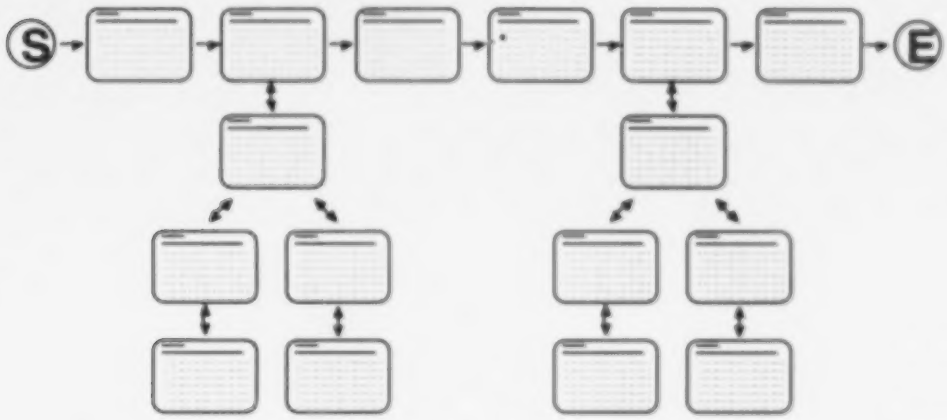
There is considerable literature on the cognitive parameters in relation to collaborative and problem-oriented learning (Roschelle 1991, von Glaserfeld 1989) and its embedding into a technological delivery framework (Soloway 1995, Spitulnik 1995), which shall not be reviewed here in any great detail.

The design of such packages must be centred on the learner and not the teacher (Soloway *et al.* 1995). Much of the multimedia design, such as self guided text cum audio and still photo or text cum video combinations, has been pre-packaged lectures and thus remain a teacher centred design. We need to be careful not to confuse multimedia, which *sensu strictu* only means the combination of various media in one teaching package, with interactive multimedia, and interactive multimedia packages, where the student is prompted with an array of options and where the student decides the direction the inquiry shall take.

On the other hand, fully learner-centred design is project or problem based and allows a student to solve a given problem by drawing on a variety of resources and conducting simulated experiments. Resource-based learning implies that the student is offered the resources embedded in a navigational structure which facilitates progress. What options do we have?

Linear mode

Linear mode with hierarchies attached



Linear mode with a star node attached

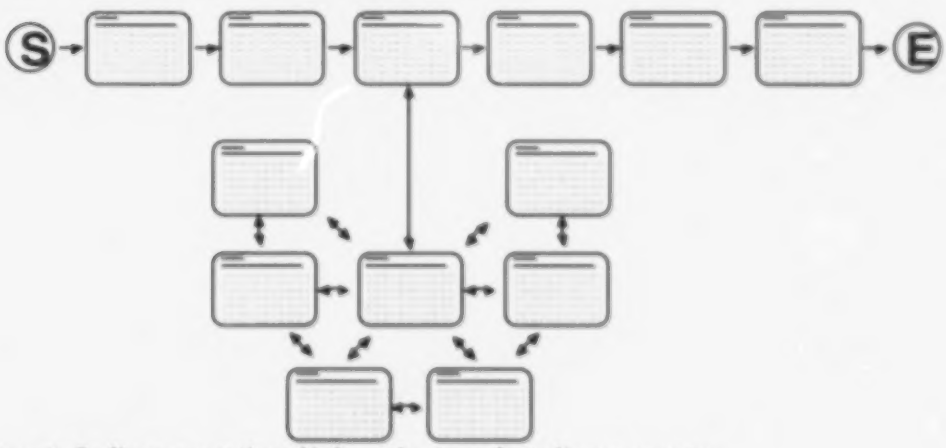
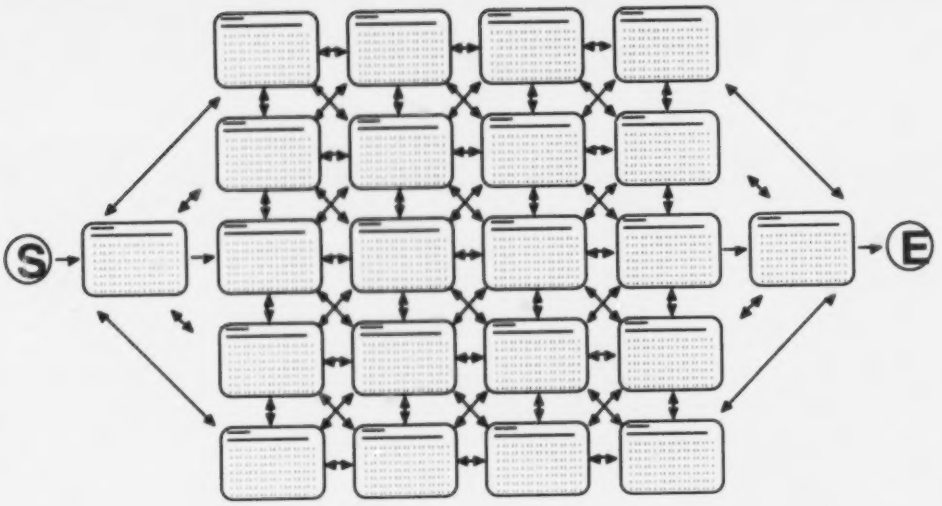


Figure 1. On-line presentation of information to students: linear concepts

Web mode



Web mode with central core

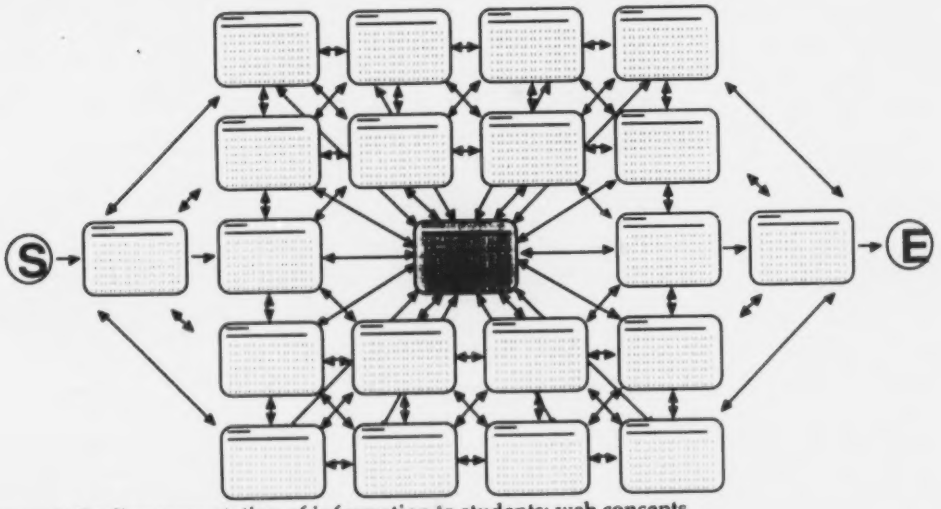


Figure 2. On-line presentation of information to students: web concepts

Some design concepts

Whilst there are capable translator programs ('rtftohtml', 'Latex', 'HTML XTND' etc.) available to convert electronic text documents into files which can be recognised by WWW browsers, there is little sense to transform print-based, and thus linear, teaching resources into linear multimedia packages. While the addition of colour illustrations, live video and sound increases the usefulness of some packages, it does little to aid students' individual approaches to learning and ultimately mastering a subject. The progress is still linear (figure 1, top). It can be enhanced by hierarchical structures, branching off selected segments (figure 1, centre). Alternatively, a star node pattern can branch off selected segments, where a hierarchical structure is established, but where the various segments of a given

level are interconnected (figure 1, bottom). Common to all these options is a general sense of linearity and a non-existence of backflow options. More complex systems include the provision of multiple and interconnected streams of segments (figure 2, top), with or without central nodes (figure 2, bottom). The teaching net thus established can be turned into a full web by adding a third dimension.

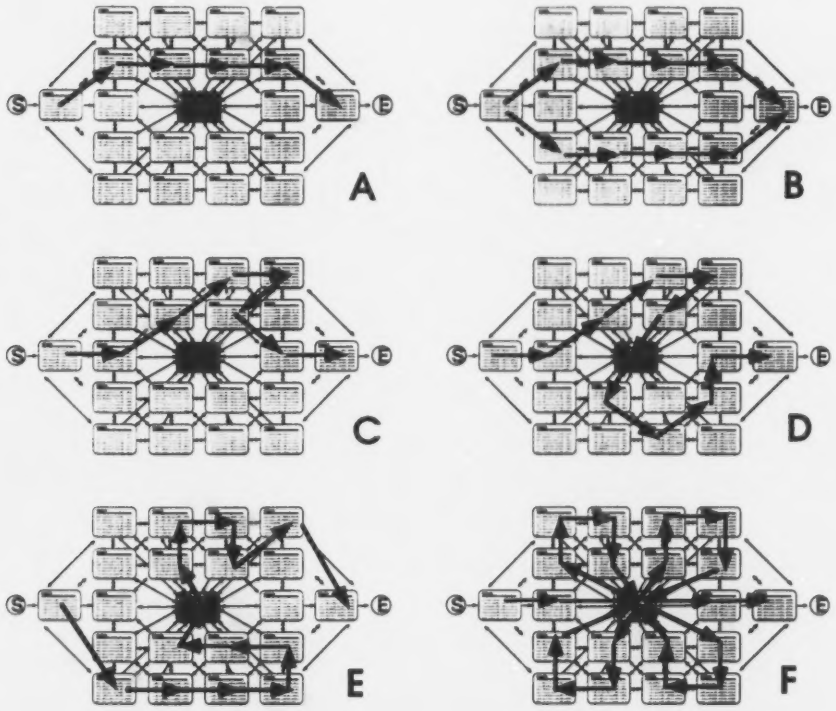


Figure 3. Various modes open to travel through a web (only a horizontal slice is shown)

Navigational features in programs enable students to control their movement through a resource, but may disintegrate into an arcade-game style 'click-and-see-what happens' program (*cf.* McKenna 1995 for lit. review). The other extreme is interactivity at the surface level, limited to queries and searches for text strings, thus facilitating browsing through masses of, potentially unstructured information. This is in the mode of extended encyclopedias (such as Microsoft *'Encarta'*), but lacks a structured approach to student learning.

Figure 3 shows some movement options through a horizontal slice of a teaching net. Some students may move straight through the web in order to reach the end (option A). If the students arrives at the membrane/bottleneck and cannot answer the questions he or she may need to re-travel part of the net (B). In both cases the net is traversed and the target reached, but the learning outcome is potentially limited. Other models of navigation are potential retracement (C) and the diagonal movement through the core (D). More complex is the multiple retracement through the core (E). This is the most likely movement of a generally interested student. Example F shows the movement of a student through the net/web by systematically entering and exiting the common core.

I believe that one can group students into one of three categories:

I those who wish to fulfil the requirements of the subject as quickly as possible;
II those who wish to complete the subject, but at the same time wish to have a good understanding; and
III those who are very interested and who wish to fully comprehend and master the subject.

While face-to-face teaching and associated tutorial allow a lecturer to facilitate a students movement from category I to II by providing the reassuring feedback and enticements, this is much more problematic in an electronic package. It entails unobtrusively monitoring a student's movement through the web and developing a notification routine which would allow the lecturer to intercede. This can be achieved in a system that is server based, such as an on-line WWW structure, but cannot be accomplished in a self-contained package on a stand-alone CD-ROM. The question of how to intercede is not of concern at this point.

In the author's opinion, the ideal concept for a multi-media package is to provide a complex linear approach as exemplified in figure 4. From a starting point a student is moved in linear fashion through a number of units which provide the student with the skills and concepts necessary to fully utilise and interact with the complex structure of subsequent parts of the teaching package. This linear element also allows one to set the scene and guide the student to the expected learning outcomes of the module. This leads the student into a web of query and learning pathways, where one unit will lead to a multitude of others, and where a student can follow any given number of pathways to arrive at the desired learning outcome. It is of importance to note that the movement through the web is not only linear but also allows for a backward flow in the web (figure 3).

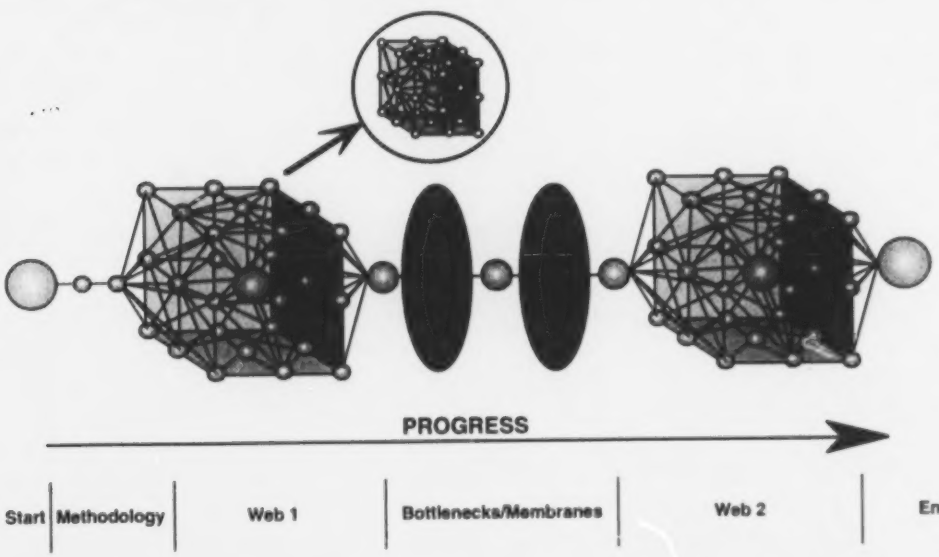


Figure 4. Schematic representation of a complex linear structure of multimedia package (see text for explanation).

In addition, of course, at each membrane multiple pathways can be established if a study package should consist of alternative modules. Ideally these bottlenecks are structured as membranes allowing only for unidirectional movement. This web→membrane→web sequence can be multiplied *ad lib*. Given the potential

complexity of a study package, it is necessary to ensure that the student can leave electronic bookmarks to pick up the thread of learning at another computer session without having to retrace the steps and to renavigate the web.

However, to move from one major module to another, the student will have to pass through a bottleneck. This can be constructed in two ways:

- linear units containing predigested information designed as reinforcement of achieved learning outcomes; or,
- linear units containing multiple choice questions with automatic or optional 'throw-back' routines to the relevant section in the previous web.

In addition, it should be mentioned that each of the small nodes in figure 3 can of course be full webs in themselves. The representation of the web as a cube is for graphical purposes only. Conceptually it may be desirable to give each web a central core node, familiar ground to which the student can 'retreat' or which the student can revisit.

One of the major dangers in a learning web is that students can become lost in the maze (Lynch 1992). This can be avoided by the provision of predefined pathways or a central core (Gleadow *et al.* 1993) or by supplying concept maps in printed or electronic form (Clark & James 1993, Mikhelson & Klease 1993).

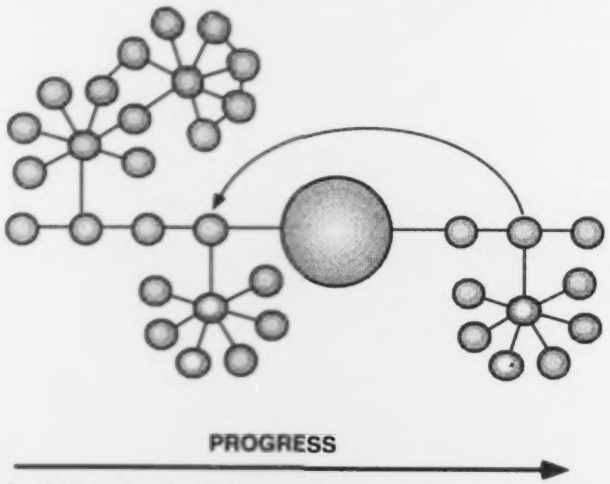


Figure 5. Concept of an interactive simulation program.

An intermediate solution to the problem is the option to provide 'panic buttons' which will take the student back to familiar ground, such as the common core, or to specific subnode points, which are indicated on the concept map. In the ideal solution, however, the 'panic button' calls up an interactive concept map, showing the student where he or she is at present in relation to the main nodes of the web, thereby allowing the student to directly navigate to a node point of choice or retreat back to the common core.

By contrast, a simulation package requires an input set of parameters which will determine the output. Student interaction is dependent on the setting of the initial parameters, as well as on making decisions along the way, based on program prompts to do so. But beyond this, there is little the student can do to interact with the program. Thus a simulation package is essentially linear, with the possibility to

re-run parts of the program after it has been completed without the need to restart it all over again.

However, the support documentation and background information provided in order to be able to run the simulation properly can be structured hierarchically, as interlinked star-nodes, or as a web structure akin to the previous example (figure 5).

Computer-assisted learning: a substitute for residential schools?

Distance education has been seen by politicians and university educators alike as the medium to introduce equity in tertiary education and allow mature-aged students the (re-)entry into the tertiary education sector. In the meantime, however, concerns have been expressed as to the costs involved in attending the residential schools required (MASC 1995), thus creating pressures to revisit the concept and to reassess whether residential schools are needed at all.

If the offerings during the residential schools are limited to lectures, much of the residential school can indeed be replaced by distance education mode. While residential schools have the ability to allow a more personal contact between the student and the lecturer, the benefits derived from this contact are negated if the class size of the residential school is too large.

The common argument for the retention of residential schools is that laboratory-based or otherwise practical skills need to the imparted under supervision, in controlled educational environments, with qualified feedback, all or most of which cannot be substituted.

It is quite clear that not all subject matter can be taught in its entirety in the distance education mode. While some can be simulated in computer laboratories (such as dissection of animals or even people to learn anatomy) most courses require on-campus attendance despite the development of home laboratory kits (*cf.* Naber & LeBlanc 1994, Warner & Wilkinson 1992). In another example, much of what was traditionally deemed necessary practical experience could in fact be dropped or substituted by computer-simulation or by home kits - even in the field of engineering (Walkington *et al.* 1994).

Some design criteria

The primary educational design criteria should be empowerment of the student to learn at his or her pace by:

(i) ease of use of the program interface;
(ii) transparency of the program's logic; and,
(iii) a screen-full of information at a time.

The primary concern for the operation of a program is the ease of use for both the experienced and the inexperienced user. One of the major concerns related to the 'traditional' underlined and blue/pink demarcated hypertext links in world wide web applications is that they are 'buried' in other text and, if presented in bullet

form, are usually of a small type face. While this can be overcome by changing the font size parameters and some judicious use of the lay-out, it is less satisfactory than the use of buttons with standardised meanings. I believe that it is beneficial to have the majority of the program driven by standard buttons which would execute an action in a foreseeable manner. This allows students to gain a level of familiarity and confidence in the use of the program.

It is important that computer-facilitated learning is just that and that a computer program does not become an end to itself. If the program has a steep learning curve requiring substantial commitment of the student's time and attention to merely understand and be able to drive the program, it fails its objectives. Whilst it will engage the student, it will not facilitate learning (Gleadow *et al.* 1993).

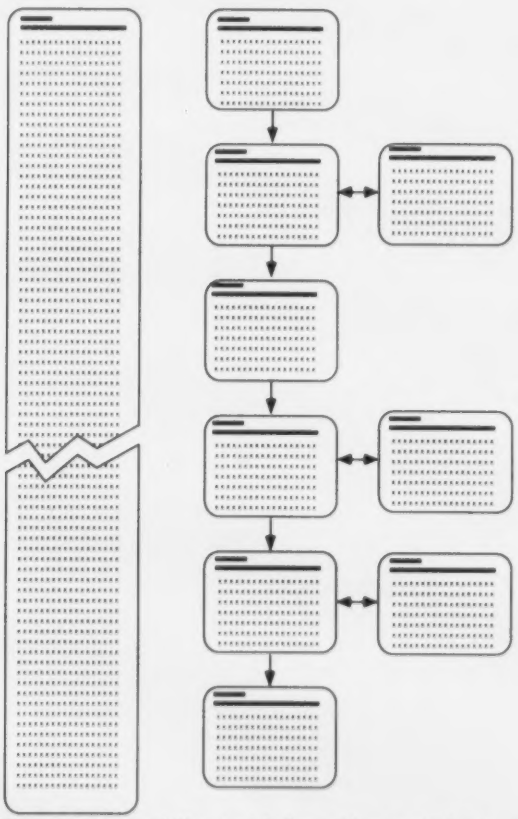


Figure 6. Conceptual differences in providing text-information to students. A continuous linear document (left) broken up into a series of sequential screens (right)

In view of the desired learning experience, long documents, requiring scrolling to seemingly endless lengths of text, are inappropriate. It is more suitable to structure the text in such a fashion that the user is being presented with a screenful of information at a time (figure 6). Only when background text files are provided to act as historic document readings, which needed to be presented as an entity in their entirety, the one-screen-at-a-time concept should be disregarded.

The following examples are drawn from the program CICRIT (Computerised Interactive Cultural Resources Inventory Training) a world wide web based survey training program developed for subject PKM 366 'Site Survey Design' at CSU

(Spennemann and Steinke 1995; URL
http://life.csu.edu.au/~dspennem/MTWILLS/CICRIT.HTM).

The background data trees for this program needed to be designed as support documents to allow students to read up on material without the need to leave the computer. Most of the data can structured in hierarchical support file trees where the student can travel up and down the individual branches of the hierarchy but not within branch levels. The advantages of this approach are that the different levels can represent different levels of detail and that the user determines the depth to which he or she wishes to interrogate the data set.

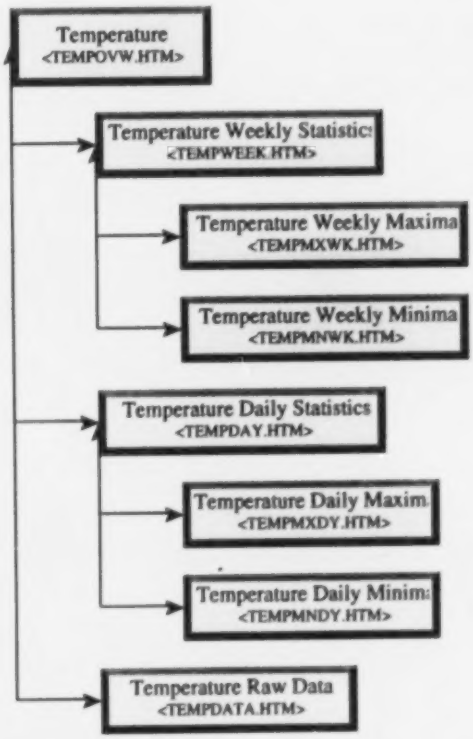


Figure 7 Example of a bi-directional support file tree.

A good example for this approach is the support data file tree presenting temperature data, which allows the access to daily or weekly data of varied detail including the raw data files (figure 7). Similar structures have ben implemented in the description of historic mines (providing descriptions, plans, photos, ore data and the like), environmental data (climate, geology, flora), logging history and so forth.

In some cases, the information contained in one of the screens needed to be accessed from a multitude of other screens. However, in the background data tree free movement was imperative. It could have be implemented by duplicating these files, but this would have been wasteful of computer data storage and it would have curtailed movement of the flow of the queries by unnecessary compartmentalisation. Thus multi-directional structures were developed which provide a complex pathway (figure 8).

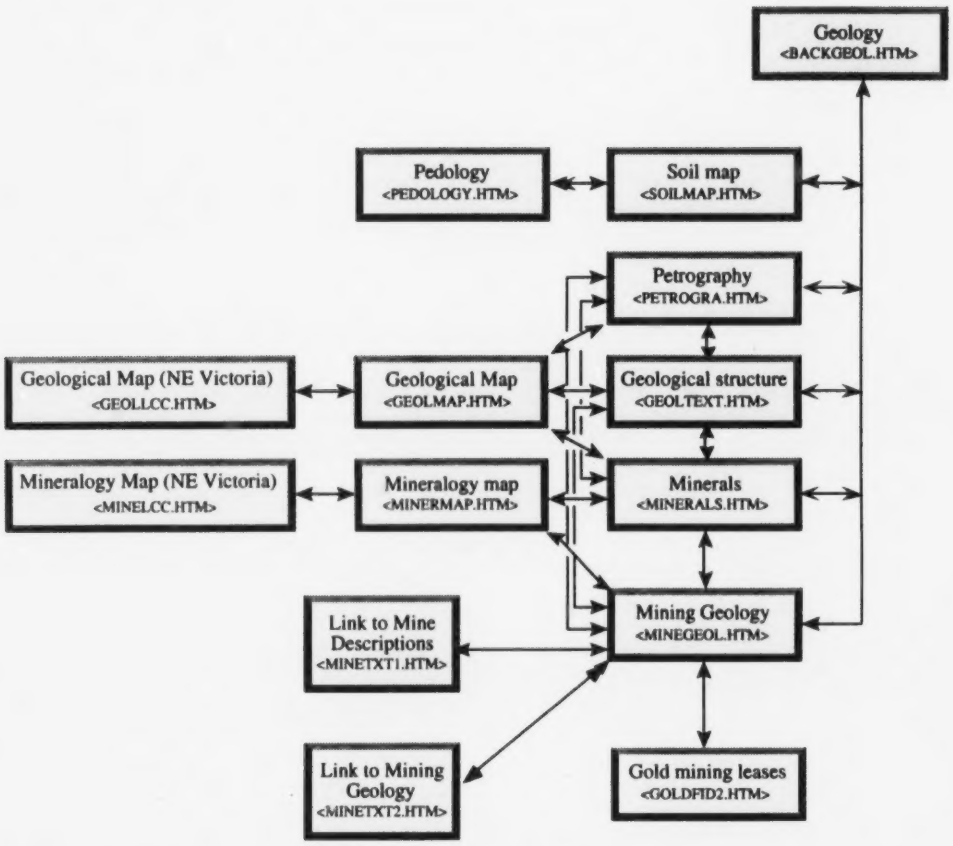


Figure 8 Example of a multi-directional support file tree (from CICRIT)

The support files of the various parameters influencing the outcome of survey design, however, include and example where multiple choice and reinforcement message routines were employed (figure 9). In this case a student is moved through the example options until the correct answer has been given. If a wrong choice is made, an explanatory screen is shown showing what the 'wrong' choice would look like. This is an example of a membrane where students can only move through once the correct answer has been given. The example shown in figure 9 does not include 'throwbacks' to segments of the program, but leads the student to a renewed set of questions.

Examinations

The electronic examination is an issue to be considered in the future if on-line packages are to become more common. There are three main options:

1) the examination to assess the students' knowledge and thereby contribute to the grading at the end of the term;

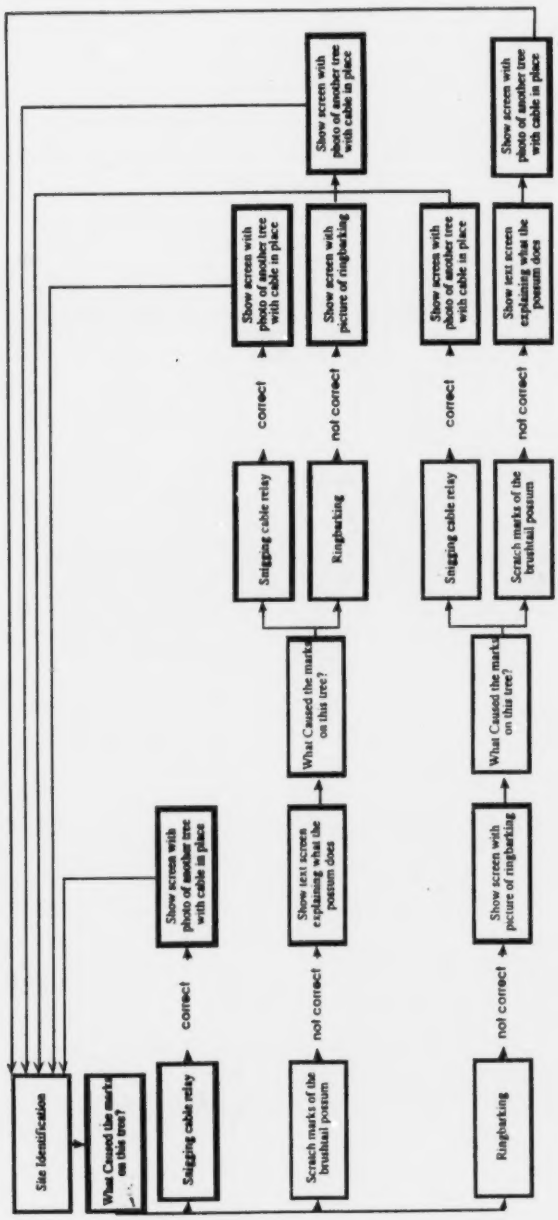

Site Identification
What Caused the marks on this tree?
Snigging cable relay
correct
Show screen with photo of another tree with cable in place
Scratch marks of the brushtail possum
not correct
Show text screen explaining what the possum does
What Caused the marks on this tree?
Snigging cable relay
correct
Show screen with photo of another tree with cable in place
Ringbarking
not correct
Show screen with picture of ringbarking
What Caused the marks on this tree?
Snigging cable relay
correct
Show screen with photo of another tree with cable in place
Scratch marks of the brushtail possum
not correct
Show text screen explaining what the possum does
Show screen with photo of another tree with cable in place
Show screen with photo of another tree with cable in place

Figure 8 Example of a multiple choice and reinforcement structure

Figure 8. Example of a multiple choice and reinforcement structure.

2) the examination of the student to understand the students' level of knowledge *without* providing grades; and,

3) self assessment tasks for students to determine their own level of knowledge.

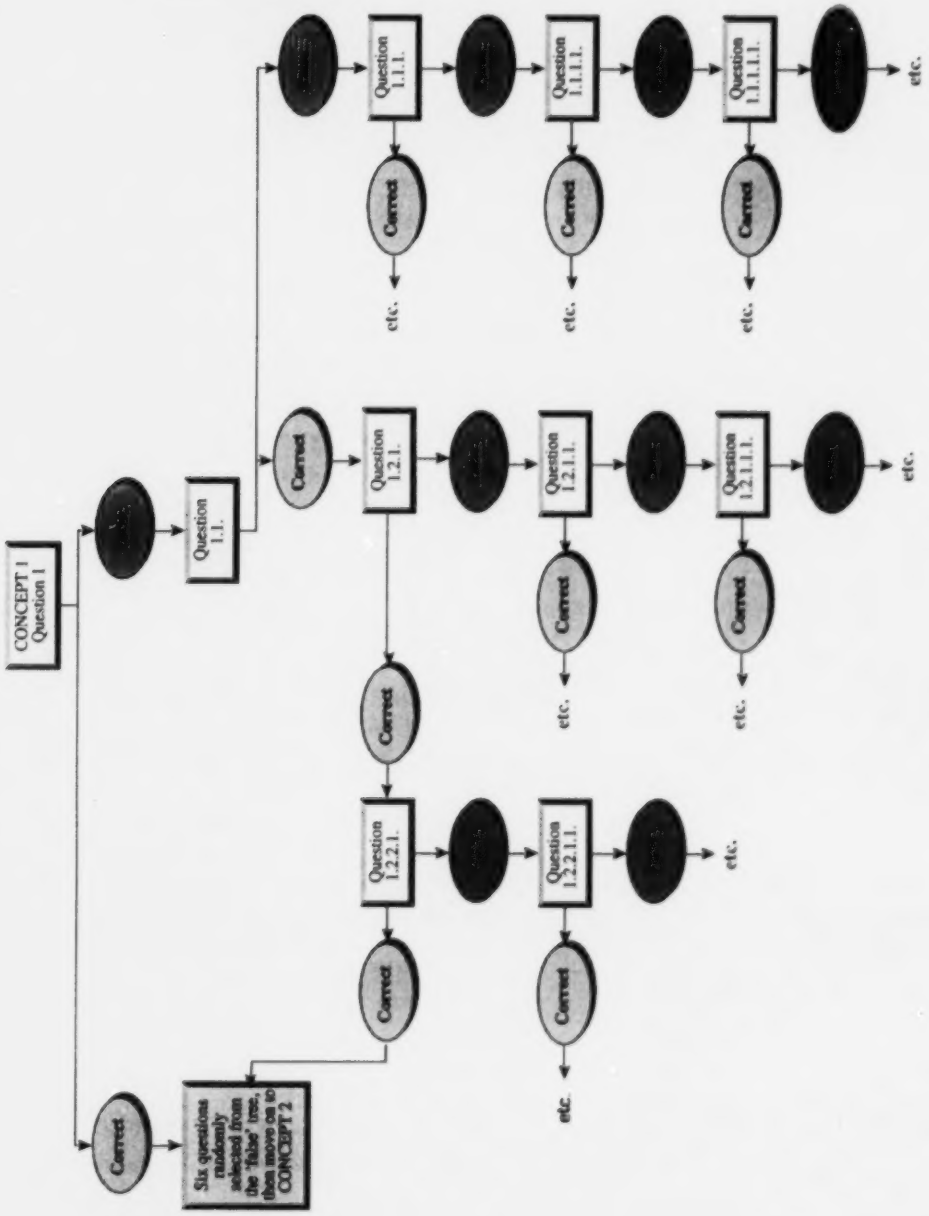


Figure 9. Example of a layered self-examination routine.

While type 1) assessments need to be fair and equitable to all students alike, the latter can be structured to assess the level of a student's knowledge in a way that exposes his or her shortcomings. The program has to start at the top level, testing a main concept or a complex issue, and then gradually peel back the layers toexpose

what went wrong with a student's understanding and where it went wrong. An example for this structure is shown in figure 9.

The key to a successful program is an open design concept, which allows the addition of future data into a teaching package or simulation program as:

- additional data and parameters become available;
- additional data and text units become available for inclusion in the background data sets;
- integration of the simulation package into the whole subject package becomes desirable.

Self-contained vs. open design

A contentious issue is the question whether the program should make full use of the network design. However, how open should the design be? The WWW allows the user to establish links to data screens and sources beyond the tight program structure and thus to rely on others to provide or fill in some of the required background information. The main argument against these links is that their presence and functionality needs to be checked at regular intervals. There is no guarantee that an embedded link will continue to work when required; it is quite possible that the network is congested, that the server containing the document is 'down', or , more problematic, that the document has been moved to a different server location or even removed altogether. This can be overcome by 'mirroring' the crucial files at one's own server. If the original is removed the mirror still contains the document and the links will still work. The retention of the document on a mirror server, however, raises issues of intellectual property rights and controls if the information is held on the mirrored server but has been deleted on the original server.

For the CICRIT program it was decided that the links to screens outside the program should not be developed at this stage, but that this could become a feasible option at a later point in time.

Conclusions

On-line study packages as aids to both on-campus and distance education subjects are becoming increasingly common. They offer great advantages over common print-based documents by enhancing student learning. However, the conceptualisation and design of such packages requires considerable thought as the author of a package needs to allow for multiple avenues of inquiry and query. As such, then, good packages will be dynamic and will develop over time as more and more experience is gained on the actual behaviour of students when learning from multi-media packages.

Acknowledgments

The present paper is developed from a report on the teaching package CICRIT (Spennemann and Steinke 1995). I am indebted to Tony Steinke who was instrumental in turning may of the concepts presented here into computational reality.

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A Hypermedia Teaching/Learning Resource For *Grape And Wine Production*

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Abstract

This paper focuses on a CD-ROM Macintosh program developed during 1994 for the Charles Sturt University (CSU) distance subject *Grape and Wine Production*. A critical reflection on aspects of the development phase is presented; then a conceptual framework is introduced to evaluate the program and demonstrate how it makes significant advances upon the original print learning materials.

Introduction

The industrial model described by Peters (1989) is still the most predominant model of distance education in the world today according to Dillon and Gunawardena (1992: 181). As Bates (1991: 11) recognises, this model still largely revolves around print and broadcast technologies but in recent years the increasing sophistication of modern computer technologies is challenging traditional practice. Bates (1993: 213) summarises the main reasons for the increasing importance of technology in distance education in the following terms:

- a much wider range of technology is becoming more accessible to potential distance education students;
- the costs of technological delivery are dropping dramatically;
- the technology is becoming more powerful pedagogically; and,
- distance education institutions will find it increasingly difficult to resist the political and social pressures of the technological imperative.

Hypermedia is an interactive computer technology which enables users to access and explore information in a multimedia environment that includes high quality colour images as well as video segments, graphics, animated sequences, sound and text; and in contrast to print-based material it presents a nonlinear learning path which can be traversed by users according to their varying background, needs and interests. Although hypermedia is an established computer technology in some educational settings, as Berk and Devlin's (1991) series of case studies illustrate, it is at the early adoption stage in distance institutions. The CD-ROM technology required as a medium for the more sophisticated hypermedia programs has not yet sufficiently penetrated the Australian market and the fact is that many students are simply unable to access the technology.

Charles Sturt University with approximately 12,000 distance students is like many other dual mode providers in Australia: it has substantial investments in print technology and over 90% of its learning materials are print-based; nevertheless in 1994 a major report entitled *A technology strategy for Charles Sturt University* (Barnard, Rebbechi and O'Donnell, 1994) was developed within the University. The report has significant implications for distance education practice at CSU and among its forty-

four recommendations it envisages the conversion of existing print based resources for distribution in electronic form by the year 2000 with a phase-in period commencing in 1997. Full hypermedia programs will be incorporated in a proportion of the University's 1,200 subjects.

The hypermedia program for *Grape and Wine Production (WSC110)* is the first produced on CD-ROM within the University and details of its conception, development and appraisal may be of interest to innovators in this area. *Grape and Wine Production* is an introductory CSU subject offered at associate diploma and degree level; it consists of four major strands (viticulture, wine production, laboratory analysis and wine appreciation) and is delivered in the distance mode in Australia and Portugal.

Rationale For Developing The WSC110 Hypermedia Program

An important consideration in the concept development phase was the capacity of hypermedia to highlight the interrelationships among the four subject strands. What occurs in the vineyard, in the laboratory and during the wine production processes closely affects the quality of the finished wine and hypermedia was recognised as being able to make this interconnectedness much more explicit and navigable than the print materials.

In May 1993 the course coordinator identified the following advantages of developing a hypermedia program for *Grape and Wine Production*:

- it allows for the use of video clips and slide demonstrations of wineries from Australia and overseas;
- video clips, slides and animated sequences are more effective at describing grape and wine production processes and equipment functions than conventional print materials;
- videos, slides and graphics can be incorporated into a logical, guided teaching format using the existing text in the current mail package;
- the use of hypermedia will be able to address some language barriers encountered by a number of European students with our traditional presentation; and
- the use of embedded links will provide opportunities for nonlinear learning and may accommodate a range of learning styles.

Development/Production Process

This phase commenced in November 1993 following project approval and the following aspects are worth commenting on:

- The *course team* consisted of eight members: the team coordinator and programmer, who had produced previous hypermedia programs and also taught hypermedia in the CSU post-graduate subject, *Computing Topics 1*; the wine science course coordinator who had worked in Portugal for eighteen months as a winemaker, lecturer and consultant; four other lecturers in *Grape and Wine Production*; an instructional designer and a video producer.

- Between November 1993 and April 1994 there were seven *meetings of the course team* which focused on such matters as content/concept mapping of the four subject strands; identification of visual resources (including what was already available and what had to be filmed or photographed); the preparation of a filming schedule, especially important for seasonal events such as mechanical harvesting and grape crushing; and consideration of early interface designs.

- *Interface design:* a decision was made to present the program on a Macintosh platform using the full 640x480 pixel screen size rather than the more customary 512x342 Hypercard pixel screen because in November 1993 this represented the best option in terms of high definition colour screen quality. Feedback from forty students attending the April 1994 residential school in the subject was obtained in a lecture theatre when the group viewed pilot interface designs and segments of work that had been completed. In discussion students indicated a preference for a user history feature and this was incorporated in the final program. Existing print Study Guide materials were also converted into computer format during this phase.

- *Instructional design* included the compilation of objectives and activities for every section and *video/photographic production* included shooting sequences in the CSU vineyards, in the winery, laboratories and at the July 1994 residential school.

- Visit by the coordinator/programmer to Escola Superior de Biotecnologia in Portugal to evaluate draft materials, arrange for an interpreter and collect Portuguese video clips and visuals. Intensive work by the coordinator with individual lecturers focussing on clarification of embedded links, glossary terms, etc. to complete programming.

Appraisal

The production of CD-ROM hypermedia programs at CSU will be closely associated with the capacity of the technology to advance upon print in significant learning areas and engage learners in new and challenging ways with subject content. Castro (1989: 238) observes that it is immensely difficult for innovators to prove that new technologies are superior to conventional means unless they have a suitable comparative and workable framework. Table 1, on the following page, has been used as the basis for critically comparing the print and accompanying hypermedia version of the subject and for identifying areas where hypermedia offers significant value-added dimensions beyond print. The framework has been derived from instructional design traditions emanating from Gagne (1970) and it outlines functions and sub-functions of learning materials.

Table 1: Functions of print and hypermedia learning materials

Major Functions	Conveying information about how the content is structured	Presentation of content	Presentation of opportunities for students to construct their own learning
Sub-functions	-arousal of motivation -heightening of intentional learning -guidance of learners through the material	-use of a variety of formats/media	-promotion of interactivity -provision of feedback

Arousal of motivation

Early engagement with the print materials registers the physical qualities of the seven books that constitute the 1995 mailing contents for this subject, the quality of the covers, binding, layout and topography; it notes the opening comments in the subject outline that this introductory subject is part of a highly vocational course sequence; and on subsequent pages that there are three recommended textbooks, three assignments, a compulsory five day residential school in Australia and Portugal and a three hour final exam. Early acquaintance with the print materials indicates this subject is extensive and demanding.

Motivation to study the hypermedia program is initially engendered by the quality of the interface design, the display of the contents for the four subject strands, the aesthetics of the four templates, their distinctive motifs, and curiosity about the ten icons at the base of the screen. The sample printout in figure 1 is a typical screen display and it indicates a limited spectrum of the interface design features.

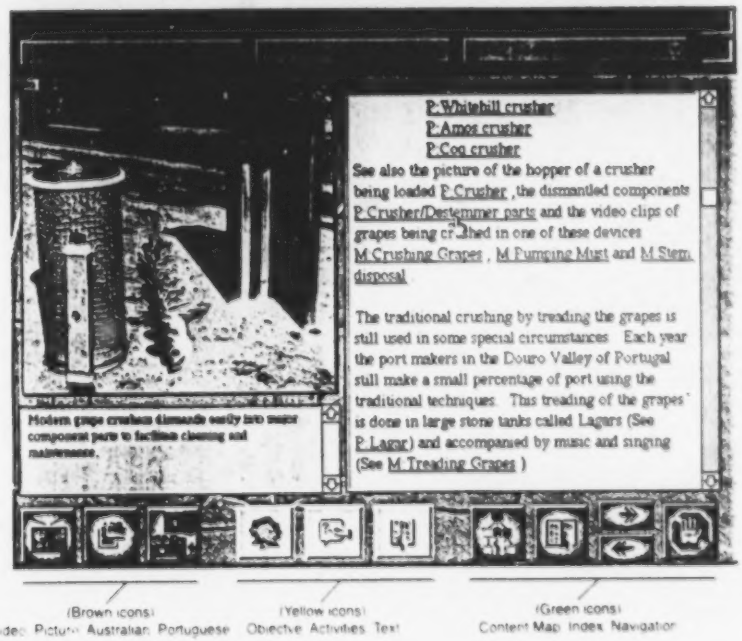
P:Whitehill crusher
P:Amos crusher
P:Coq crusher
See also the picture of the hopper of a crusher being loaded P:Crusher , the dismantled components P:Crusher/Destemmer parts and the video clips of grapes being crushed in one of these devices M:Crushing Grapes , M:Pumping Must and M:Stem disposal
The traditional crushing by treading the grapes is still used in some special circumstances. Each year the port makers in the Douro Valley of Portugal still make a small percentage of port using the traditional techniques. This treading of the grapes is done in large stone tanks called Lagars (See P:Lagar) and accompanied by music and singing (See M:Treading Grapes)
(Brown icons)
(Yellow icons)
(Green icons)
Content Map Index Navigator

Figure 1: Sample printout of *Grape and Wine Production* hypermedia program

Heightening of intentional learning

Intentional learning in the print materials is promoted through traditional aims and objectives but the hypermedia program places greater prominence on intentional learning through the function of the yellow icon represented as a question mark. Clicking this icon enables one to access specially written objectives; section objectives can be called up at any point of study to appear in a separate box and it is also possible to sequentially explore all topic objectives. The icon on the left displays sample questions which also focus students' learning on the objectives for that section. The integration of objectives in this way within the program is one of a range of strategies designed to reduce aimless browsing.

Guidance of learners through the material

Guidance through the print materials is provided in the form of tables of contents, study advice, traditional activities, signposts to and comments on the readings in the Study Guide, and an assessment schedule which indicates the sequence of topics to be studied; progression through the laboratory manuals is based on the series of practicals at the residential school.

The hypermedia program seeks to facilitate user orientation as well as accommodate individual differences in learning. Broad navigation guides are provided not only by the main menu, but the topic, section, related topics and numbers which appear at the top of each screen. The user history feature which enables learners to skip completed topics or to resume where they quit last time appears on the main screen. It is also possible to hide or show links between all sections on the content map; this is an intricate navigation device which makes explicit the interconnectedness of the subject strands.

In figure 2 the lower horizontal panel contains a set of colour codes and grouped buttons which perform specific functions for users. The leftmost group of brown buttons allows students to select available video, picture and language default (hence the icons of a TV, visuals and the Australian/Portuguese flags). The screen text is in English but students can use Portuguese for all glossary terms and captions. All terms underlined on the screen contain embedded links to glossary definitions or physical resources such as video clips or pictures. The three yellow icons in the centre are used to display objectives, activities and text while the group of green icons on the right is used for navigation purposes. The rightmost three icons are self-explanatory while the other two are used to display the content map and an alphabetical index of key concepts. M and P symbols in the screen text indicate video and picture files but users can also independently determine the number of files available on that screen because the numbers appear within the two leftmost icons. Video clips contain scroll bars which can forward, stop and reverse sequences, and all video and picture files are accompanied by individual explanations. The interface design allows learners to immediately orient themselves and thus minimises the possibility of getting lost in the large information space.

Use of a variety of formats/media

Ninety five percent of the print materials are text based but an additional range of non-linguistic forms are used to present subject matter. The viticultural topic in the Study Guide contains figures of buds, leaves, fruiting structures, different species and

leaf characters; in wine production there are a series of diagrams, graphs and flow diagrams to represent basic winemaking processes; aspects of winery engineering are also presented as graphics including figures of presses, fermenters, storage tanks and must separation. All of the graphics in the print materials are in black and white and there are no photographs.

The program contains 142 screen pages of text, over 200 picture files and 22 movie clips which consist mainly of video sequences but also contain several graphic animated sequences such as the operation of the tank press. The picture files contain images from slides, several series of coloured graphics to represent seasonal stages such as in budburst, coloured maps, tables, graphs and charts. Diagrams which appear in the print materials such as the international tasting glass and the diagram of the tongue and its taste buds are considerably enhanced in the new medium. Graphs and tables in particular are presented in a range of vivid colours so that a new dimension is introduced, facilitating interpretation. Portuguese picture files of grapevine canopies and video clips of manual harvesting and treading grapes (lagar) are also included. The operation of expensive machinery such as the mechanical harvester is shown very clearly for the many students enrolled in the subject who have not seen this technology.

Promotion of interactivity

Opportunities for students to construct their own learning in the print materials occur principally in the Assignment Booklet which contains the details and in many cases the answer spaces for the three major assignment items; there are also opportunities for students to record comments, observations and results in the other books. The hypermedia program in contrast provides opportunities in every section for learners to interact with the screen content in the form of a considerable range of study activities and questions. The questions generally use terminology such as '*why, when, where, describe, put into correct sequence, list*, etc' and all responses are verifiable within the program. Although users are not able to interpolate typed comments and print them from the program, the sophistication of the interface design provides considerable scope for learner control and initiative.

Provision of feedback

The source of feedback in the print materials are the corrected assignments and the written observations and results recorded in the practical manuals at residential school. Responses to all questions that have been designed in the hypermedia program can be ascertained by interaction with the text and visual files. The emphasis has been on promoting independent, critical learning based on observation, interpretation and analysis. Rather than provide answers to highly structured, lower order cognitive skills such as simple recall/memory styles, often cast in the form of true/false, multiple choice, cloze and matching questions, the design emphasis has been on encouraging learners to return to the program, constructing and verifying their own learning.

Conclusion

The hypermedia resource demonstrates advances upon the print materials in significant learning areas. The integration of movie and picture files with the text show how the strength of hypermedia technology can illuminate dynamic wine production processes and equipment functions; similarly, the contrasts between Australian and Portuguese viticultural environments, the representation of laboratory processes, seasonal stages of growth and practical vineyard skills acquire a new dimension on screen. The option of Portuguese as a default language for selected functions, the use of an interpreter and the inclusion of Portuguese materials in the program indicate ways in which the context of overseas students can be addressed in learning materials. The development phase of this program also required teaching staff to conceptualise their discipline areas in very precise ways, especially in terms of their relationships with the total spectrum of *Grape and Wine Production* and ironically competencies acquired in this process are likely to lead to refinements in the print materials when they are next revised.

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Study Duration Of Post-Graduate Distance Education Degrees Offered By Australian Universities

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Abstract

A study of 174 graduate diploma and masters by coursework courses offered by distance education mode in Australia has shown a wide variation in study duration between the scheduled minimum and the actual average rate of progress. While part-time graduate diplomas were commonly completed in 1.5 years rather than two years, part-time masters courses took on average one year longer than scheduled.

Introduction

At present an informal, and in many cases covert debate ensues whether Masters by Coursework courses ought to be shortened to 18 months or even 12 months duration. The 'active' proponents of this concept argue that the 'market' requires high-quality, high intensity, but nonetheless brief degree courses, along the 1-year MBA concept prevalent in the USA. The 'passive' proponents maintain that the abbreviation of courses by some Australian institutions forces the other universities, among them CSU, to follow suit in order to remain competitive. The opponents argue that any shortening of the courses would result in a reduction of the subject volume and hence content offered and thus would lead to a decline in degree quality, ultimately devaluing the degree as a whole.

In order to place this debate in the context of what is currently happening in Australian Universities, a study was conducted to compile information about the current mood of the Australian education providers. While that study is primarily a part of an internal review of Charles Sturt University, School of Environmental and Information Sciences, to assess the relative position of its own graduate diploma and masters by coursework offering, and to aid in the decision making processes, it has application beyond the initial audience. While the full report has been presented elsewhere (Spennemann and Montfort 1995), this paper will look at the study completion patterns and will draw out some implications.

Methodology

The survey was conducted in April 1994 by questionnaire mailed out to the course coordinators of those graduate diplomas and masters by coursework courses which were offered in distance education mode in 1994. The courses to be targeted by the questionnaire were extracted from Savatich (1992). The questionnaire was designed to target specific issues relating to this level of higher education, such as offering of

summer schools, residential schools, requirements and marking of theses, and the like. Of the possible 285 returns there were 171 respondents, three of whom provided extra information regarding other courses at their institutions relevant to the questionnaire. Nine of the courses surveyed are no longer offered. In addition, five responses arrived late and could not be incorporated into the analysis.

The response rate was approximately 60%. Of the information given, 101 relate to graduate diplomas, 65 to masters and eight to postgraduate diplomas. For the purposes of this study, the information on graduate diplomas and postgraduate diplomas was grouped together.

The data

For the analysis of the duration of courses we need to differentiate between the (scheduled) minimum time it would take to complete a course, and the average time it actually takes a student to move through. The former reflects the course coordinator's (or university administrator's) ideal, while the other reflects reality. The questionnaire asked for the following information:

Duration (minimum):	part time —— yrs: full time ——yrs
Duration (average progress):	part time ——yrs: full time ——yrs

Respondents were required to fill in the above information on course duration. This question was not always answered as perhaps for some of the courses course coordinators may not have had the relevant data in hand or were not willing to divulge it. Obviously while the individual rate of progress depends on both the ability of the student and externalities such as pressures at work, family matters and the like, the *average* rate of progress should eliminate this variability. It needs to be considered, though, that this information was solely based on course coordinator's opinions and no statistical analysis was conducted at either end.

The courses were grouped into six major study directions of study: business, education, applied science, science and information technology. Figures 1 and 2 present the data in the form of bubble charts, with the size of the bubbles reflecting the frequency of the responses. We refrained from normalising the responses to a base of 100 as we believe that it would have created a false sense of reliability and comparability of the data.

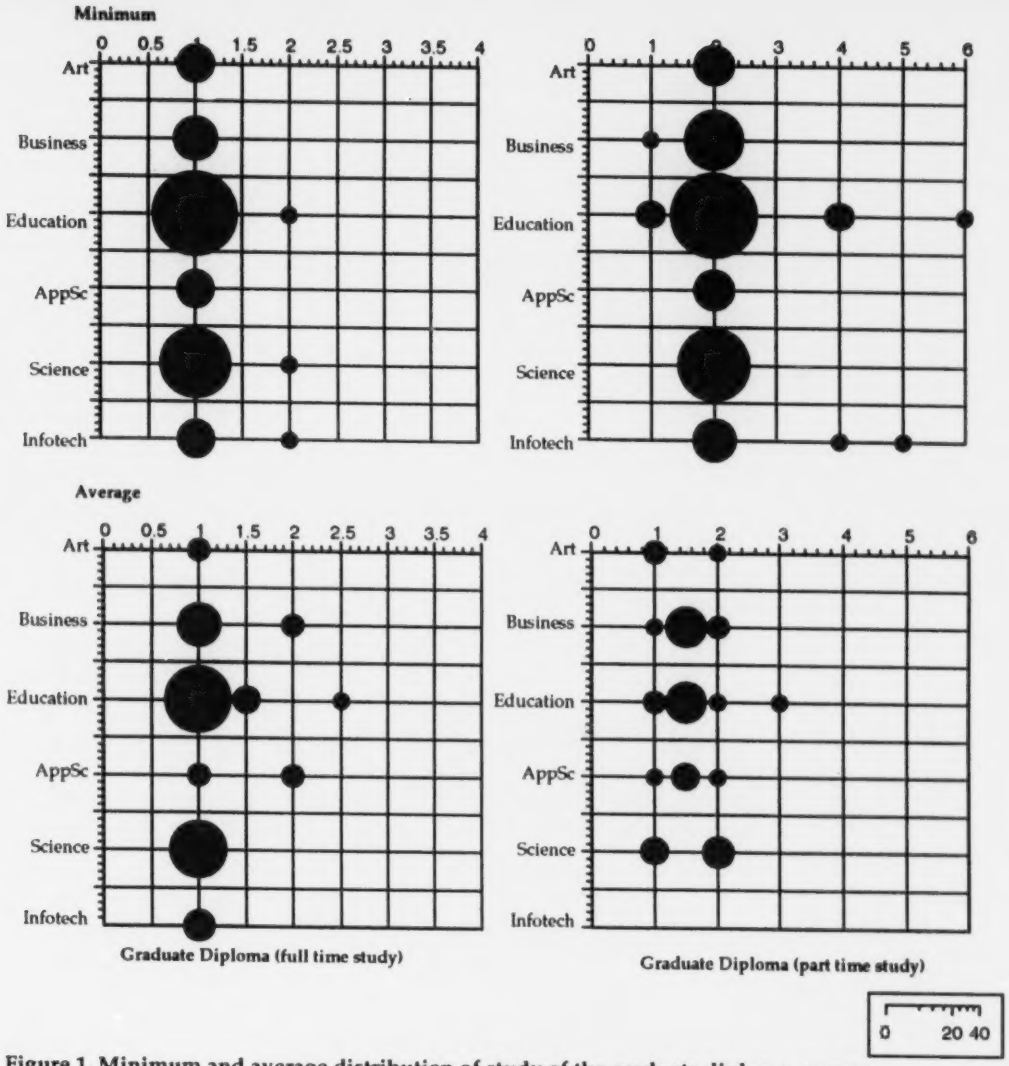

Figure 1. Minimum and average distribution of study of the graduate diploma courses

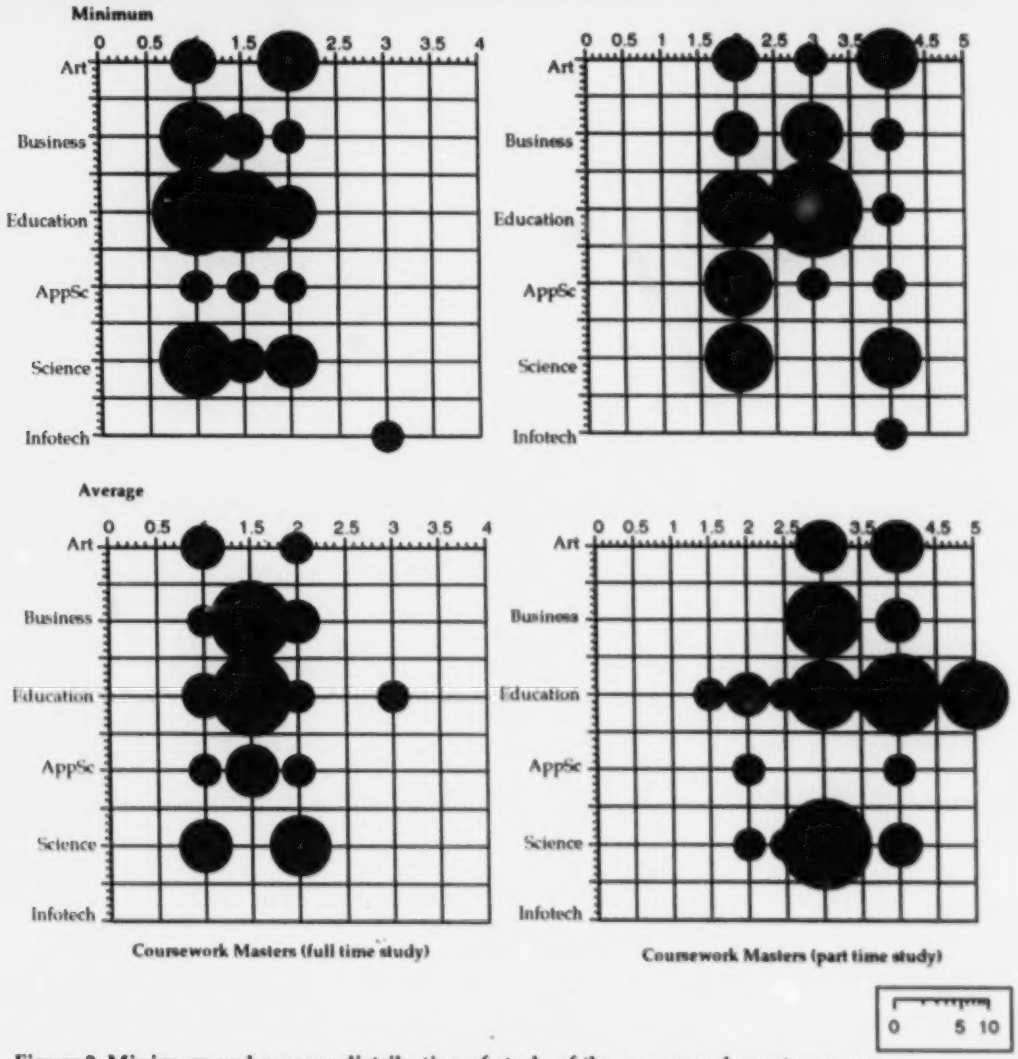

Figure 2. Minimum and average distribution of study of the coursework masters courses

Depending on the direction of study, the average duration for master and graduate diplomas ranged from as high as six years part-time to one year full-time. The minimum duration was between four years part-time to one year full-time. The average duration of masters courses studied part-time is three years in comparison to a minimum or assumed standard of two years. The average full-time duration of a graduate diploma is one year, although 1.5 years is the dominant trend for business and education, in comparison to a one year minimum. It is interesting to note that three years is the average part-time duration within the category of Science whilst some Education courses nominate three years as the minimum. These observations demonstrate that the terminology and the standing of the 'Masters' and the 'Graduate Diploma' varies widely across the disciplines. In addition, there is a distinct variation among the Universities.

The study has not attempted to gauge the relative standing of the courses, in order to assess whether the industry perceives a quality differential and whether this differential has any correlation with overall study time.

Discussion

On a general note, it is of considerable interest to note that in part-time mode a *graduate diploma* can be completed, on average, faster than the 'normal' part-time completion time. On the other hand, a masters takes much longer to complete than the predicted 'normal' time. This is especially true for the study direction of education. In the context of the graduate diploma this would indicate that students take on more than the expected part time load of subjects. To some extent this may be due to judicious use of (additional) summer schools. However, not too many courses offer this option (Spennemann & Montfort 1995). Therefore, it seems that studying at a 0.75 rather than a 0.5 load during part or all of the course would be main reason. It would appear that the course duration of a graduate diploma is so brief that students have an incentive to complete it rapidly. On other hand, it seems impossible to complete a graduate diploma in less than one year, i.e. the study load is such that students are saturated.

The charts show clearly that the distribution of study duration of the *masters*, both minimum and average is patchy with only some trends clearly developing. The problem is exacerbated by the disparity of the frequency of answers. However, the plots clearly show that the minimum duration (i.e. the expectation of the course coordinators) has little to do with the reality (i.e. the averages). In the full time mode students tend, on average, to take about one term longer than expected, while in the part time mode it is two terms (which is the equivalent study load). The greatest spread occurred in the study direction of education, where instead of the anticipated average of 1.5 years the bulk of students took between three and five years. Education is the only study direction where this spread occurred. As can be expected, though, the pattern of actual average study in the part time mode is scattered, reflecting the different demands and student's time availability.

Some Implications for CSU

The above observations have some implications for distance education providers. The increased rate of progress for the graduate diploma would allow students to gain mid-year enrolment and still graduate on the same day as those beginning their course at the beginning of the year.

As far as the masters is concerned the need for increased study time should to be investigated. Part of the reason may well be that the completion of the thesis component poses problems and ultimately causes delay.

On the other hand it is worth considering that a student's approach to a two year part-time degree may well be very different to that to a four year degree. While the former is so brief that a speedy completion is desirable, and achievable, the four year degree may create a feeling that another term worth of delay is not really going to matter, thus inducing the student to move through the degree at a reduced pace.

Another issue to be considered is whether this delay in study completion is caused by an approved reduced study load at the time of (re-)enrolment, or whether students pulled out of some subjects during term. If the latter is the case, the student is likely to have incurred HECS for the withdrawn subjects, thus creating an additional financial

burden. The longer than scheduled duration of the masters degree should give some pause for thought: -

- is the subject matter too demanding?
- is the supervision adequate?
- is the choice of thesis topics appropriate?
- is the administration too lax?

A minimum part-time completion ratio of 25% of a full-time study load would in fact allow a student to take eight years to complete a four year part-time degree. Thus the study duration is not as long as it could be. Nonetheless, given the administrative aspects of regulatory changes, degree standards and degree/subject contents, tertiary education providers may well consider tightening up the rules or enforcing them more stringently.

Conclusions

A study of 174 graduate diploma and masters by coursework courses offered by distance education mode in Australia has shown a wide variation in study duration between the scheduled minimum and the actual average rate of progress. While part-time graduate diplomas were commonly completed in 1.5 years rather than two years, masters courses took on average one year longer than scheduled.

It could be shown that the graduate diploma students studying part-time on average complete their study in 1.5 years as opposed to the assumed duration of two years. This could imply that CSU may wish to consider a half-term enrolment option for students in the Graduate Diploma courses. This enrolment could make up for those students dropping out and would allow for an increased throughput of students while assuring their graduation in a 'normal' fashion.

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Student Evaluation Of Concepts Of Biology

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Abstract

This paper discusses response patterns to items in a student survey questionnaire designed specifically for the subject, Concepts of Biology. The discussion is based on quantitative and qualitative data extracted from 201 questionnaires which represents a return rate of approximately 77%. Issues discussed include students' level of satisfaction with the subject, aspects which caused problems, reactions to the study materials, interactive tasks and practical work as well as suggestions for future offerings of the subject.

Introduction

Concepts of Biology is a first-session introductory biology subject offered to students in a wide range of science-based courses including Medical Laboratory Science, Environmental Science, Park Management, Biotechnology and Analytical Chemistry, as well as students in other courses such as Arts, Agriculture, Education, Occupational Therapy, etc. As a general introduction to biology, Concepts of Biology covers the gamut of biological principles and disciplines without emphasis on any particular aspect, and provides a broad knowledge base for a variety of later specialist biology subjects. No prior knowledge of biology is assumed although significant numbers of students have studied biology at HSC level.

Concepts of Biology replaced three previous campus-specific subjects, and the teaching materials were designed by a team of four lecturers drawn from all three campuses. The subject was offered on all three campuses for the first time in Autumn 1994, by internal and distance modes at Wagga and Albury, and by internal mode only at Bathurst.

Teaching Materials

The mail package for Concepts of Biology consists of a Subject Outline, two Study Guides and a manual of Practical Exercises. The theory component of the subject was divided into nine Parts each consisting of several Topics. Study Guide 1 covered the subject matter in the first half of the session (Parts 1 - 6) and Study Guide 2 dealt with topics from the second half (Parts 7 - 9).

The Study Guides include a number of teaching strategies which had not previously been tried in introductory biology at CSU. One of these, the use of icons, is described in a separate paper (Wood 1995b). Interactive learning tasks of various kinds (Wood 1995a) were also trialed. The Practical Exercises are essentially a compendium of exercises which had proven successful at one or more campuses in the past, but one innovation for 1994 was the implementation of a three-day, rather than four-day, residential school at Wagga and Albury.

Survey

A survey questionnaire was designed specifically for Concepts of Biology, based on previous questionnaires from a variety of sources, with additional material to address specific aspects of the subject for which student feedback was desired. Students were also encouraged to provide written comments on the form. This tailor-made survey was used in place of the general-purpose OLI Subject Evaluation Questionnaire for distance students.

The survey consisted of a number of statements to each of which students provided responses on a four-point scale (strongly agree, agree, disagree, strongly disagree). The form itself was divided into a number of separate sections, the first of which covered a number of aspects of the subject as a whole, including expected prior knowledge, workload, nature of assessments, amount of feedback, subject organisation and students' level of satisfaction and motivation.

The survey also covered student reactions to the study materials (textbook and Study Guides) and the interactive tasks, as well as to the practical aspects of the subject. Except for the section relating to practical work, survey forms for internal and distance students were identical, with the former responding to statements about the weekly practical classes and the latter to corresponding statements about the residential school. The final section asked students to provide comments about aspects of the subject which they particularly liked or disliked; there were also spaces for comments after every section of statements. Student responses to the use of icons are discussed elsewhere (Wood 1995b).

Survey forms were distributed to lecturers on all three campuses for internal students, while distance students who were still enrolled and studying in May 1994 (excluding students who had already been awarded grades of AW, XX or FW) received a survey form by mail along with a reply-paid envelope. Due to an oversight internal students at Albury campus were not surveyed, but the other four cohorts (Albury distance, Wagga distance, Bathurst internal, Wagga internal) were included and it is their responses to the survey which are summarised below; direct quotes from student comments are shown in italics.

Return Rates

As expected, both internal groups had high return rates (Table 1) since the survey was carried out during a scheduled class and forms were returned immediately. However there was no compulsion to participate and a small number of students chose not to do so. For distance students, return rates for this survey were considerably greater than the usual responses to the OLI questionnaire. This is probably because the latter are enclosed with the first mail package and students must retain them for several months and remember to return them with their final assessment task, whereas the former were sent out in a separate mailing approximately two weeks before the nominated return date and returned in a separate reply-paid envelope.

Table 1: Return rates for Concepts of Biology student survey

Cohort	Number of Forms	Number of Responses	% Return
Albury Distance	56	24	42.9
Wagga Distance	43	22	51.2
Total Distance	99	46	46.5
Bathurst Internal	33	31	93.9
Wagga Internal	87	78	89.7
Total Internal	120	109	90.8
Grand Total	201	155	77.1

General Subject Evaluation

Student responses are shown in Table 2. The patterns of response were similar for most questions regardless of campus or mode of study; however some questions elicited responses which were quite campus-specific (e.g. Wagga internal students had problems with textbook availability), and in some cases responses were different between distance and internal students. In general the level of satisfaction with Concepts of Biology was high, as was motivation to continue with studies; 85 - 90% of students agreed with these statements. Over 90% of respondents had no difficulty in understanding the way Concepts of Biology was organised, and over 80% were able to follow assignment instructions without problems. Having several lecturers contributing to the mail package was seen as an advantage, although this statement had the lowest response rate indicating that for some students the authorship of the teaching materials was an irrelevance.

> I learned a great deal and thoroughly enjoyed doing it.
>
> The course has a lot to offer as it is very interesting.
>
> This subject gave me things to think about, which I had never thought about before.
>
> The assignment questions could be a little clearer.
>
> Good background for future study.

Table 2: Responses to general section of survey (% responses in each mode of study)

Statement	Mode	SA	A	D	SD
I clearly understood instructions concerning the organisation of the subject	Dist	37.8	55.6	6.7	0
	Int	37.5	58.7	3.8	0
I had the necessary background knowledge for study in this subject	Dist	28.1	52.2	17.4	4.3
	Int	44.9	29.9	16.8.	8.4
I had no difficulty obtaining the textbook	Dist	29.5	50.0	8.9	11.1
	Int	22.9	27.5	29.4	20.2
I felt that I gained from having different lecturers involved in writing materials for various sections	Dist	15.0	65.0	20.0	0
	Int	16.3	75.0	6.5	2.2
The assignment instructions were clear and easy to understand	Dist	28.9	57.8	13.3	0
	Int	22.2	62.0	13.9	1.9
Adequate feedback on progress was provided in this subject	Dist	13.3	22.2	46.7	17.7
	Int	13.9	67.6	16.7	1.9
Assessment tasks covered important aspects of the subject	Dist	6.7	73.3	17.8	2.2
	Int	22.4	57.9	18.7	0.9
I found the workload for this subject reasonable	Dist	6.5	56.5	21.7	15.2
	Int	24.8	67.0	7.3	0.9
The subject schedule enabled me to prepare properly for the exam	Dist	11.1	53.3	28.9	6.7
	Int	17.4	63.3	12.8	3.7
Overall I was satisfied with this subject	Dist	19.6	65.2	13.0	2.2
	Int	29.9	57.9	13.1	0
The relative weightings of assessment items were reasonable	Dist	9.1	65.9	25.0	0
	Int	16.8	77.6	4.7	0
After studying this subject, I am motivated to continue further study in this course	Dist	32.6	52.2	13.0	2.2
	Int	35.5	54.2	7.5	2.8

Aspects of the subject which caused some problems for distance students included magnitude of workload and adequacy of feedback. Although average hours of study were stated for each Topic, it is difficult to give a hard and fast indication of the amount of study required since an individual's study load is dependent on several factors, including effectiveness of study skills, previous knowledge of the subject, time available for study and interest in the subject matter. Subjective perceptions of what constitutes an excessive workload surfaced in this survey, with students apparently comparing the workload in Concepts of Biology either favourably or otherwise with the corresponding load in the other subject in which they were enrolled. It is possible that the negative responses regarding feedback were also coloured by past experience; students whose previous study was full-time may have unrealistic expectations about the nature and speed of feedback in the distance mode. These problems are being addressed in Concepts of Biology by more explicit statements of assignment return dates and recommended hours of study in the Subject Outline.

> The workload was heavy for not only myself, but others. The degree of difficulty was not great.
>
> Workload far too much. Spent all week summarising topics. Had no time for understanding and revision.
>
> Needed more time to do subject properly.

More feedback on progress would have been helpful.

Promptness of returning marked work.

More feedback to students on assignments, practical books and exams would be beneficial.

Distance students were also more negative about the week-by-week study schedule; written comments indicated that the root cause was late arrival of the mail package and/or the textbook which delayed the start of study. Late dispatch of the Concepts of Biology mail package in 1994 was a one-off event caused by delays at various stages in its production, and will not be a problem in future years.

Due to extreme trouble with obtaining the textbook the whole study schedule was about 3 months behind.

The subject schedule would have been very good for exam preparation if I had not received mailing materials two or three weeks late!

Most students felt that assessment tasks were related to important aspects of the subject, although 25% of distance students expressed dissatisfaction with the relative weightings of assessment items. In the light of these responses, the 1995 Subject Outline has been modified to clarify the relationship between assessment items and subject matter.

I felt that the second assignment was due too soon after the res school.

I feel that various assignments (at intervals) throughout the course could have been included to check progress.

Assessment could be weighted more to the practical and assignment side.

Interestingly, the proportion of students who believed that their background knowledge was insufficient was similar regardless of study mode; it might have been expected that distance students would see this as more of a problem than internal students who are to a large extent recent school leavers. On the other hand, some students (who presumably had studied biology previously) commented that the subject matter was pitched at too low a level and did not extend them sufficiently. Such conflicting opinions, arising from a wide diversity of previous academic experience among a subject's clientele, present a problem to designers of teaching materials; within any cohort of students there will always be a proportion who will struggle and some who will find the subject easy to the point of boredom.

Since the survey was performed less than two weeks before the final exam when self-confidence was probably at a low ebb, the perception of inadequate preparation may have been unrealistically strong, especially since the proportion of students who expressed this view was substantially greater than the proportion who subsequently failed the subject.

I have found the course difficult as I have no or very little biology background.

Future 'mature age' students may benefit from a 'Basic Bio' course to refresh the brain cells. It was a bit daunting doing a subject that I hadn't studied for over 15 years!!

Not at the level I was expecting - quite a simple level.

Fascinating subject, would (have) liked to have seen the mid-session exam at a more difficult level, felt I was capable of much more at this stage and was a little disappointed.

Study Materials

A group of statements was included to gauge student responses to the study materials as a whole. In particular we were interested in whether the style of presentation adopted for the Study Guides fulfilled the requirements of students new to tertiary study, how well the textbook was received and whether the material in the Study Guides was pitched at the correct level for the majority of students. Responses.are summarised in Table 3; both distance and internal students responded very positively to the study materials, indicating that both design and depth are suitable for the overwhelming majority of students. The textbook used for Concepts of Biology (*Biology* by Starr and Taggart) includes review and self-test questions at the end of each chapter; the finding that over 90% of students believed these questions helped with their understanding should be discounted to some extent as an expression of good intentions rather than fact (the response rate for this statement was among the lowest), but does indicate nevertheless that this feature is perceived as useful by almost all students.

I found the Study Guide well set out and presented.

Limited time for study prevented me from using review questions and self tests adequately.

Study guides reinforced and added to information in text. They also concentrated on important areas.

Study guide should have acted more like a core set of notes than an aide to the textbook.

Please give us study guides in all other subjects.

Table 3: Student responses to study materials

Statement	Mode	SA	A	D	SD
The layout and presentation of study materials was clear and easy to follow	Dist	33.3	57.8	8.0	0
	Int	45.0	53.2	1.8	0
Review Questions and Self-Tests in the text allowed me to gauge my understanding of the subject	Dist	37.0	58.7	4.3	0
	Int	23.5	67.6	8.8	0
There was too much information in the Study Guides	Dist	2.2	4.3	80.4	13.0
	Int	0	4.6	64.8	30.6
The Study Guides clarified some points that were not clearly explained in the textbook	Dist	28.9	55.6	15.6	0
	Int	29.0	58.9	12.1	0

Interactive Tasks

Several different types of interactive tasks were included in the Study Guides. These were intended to introduce techniques for summarising and comparing information, to highlight important points and to prompt students to find information for themselves. Interactive tasks allow the study time to be punctuated by a number of different activities, and thus hold the student's interest by avoiding prolonged periods of straight reading.

Responses to the interactive tasks (Table 4) were consistently positive, with the time required to complete the tasks the only aspect perceived as somewhat negative. Interactive tasks were more favourably received, and more likely to be used, by distance students who necessarily rely on them to a greater extent than do internal students.

> The spaces allowed me to test myself and provided a summary to revise.
>
> Didn't use them. Information would not be remembered if only writing down words, not facts.
>
> The more you write the more you remember.
>
> This area of the Study Guide was extremely helpful in understanding the work. I would like to see more of this in study guides.
>
> The time it took to fill in SG was too much.

Table 4: Student responses to interactive tasks

Statement	Mode	SA	A	D	SD
Having spaces to fill in helped to develop my study skills	Dist	41.3	54.3	2.2	2.2
	Int	48.1	42.6	6.5	2.8
The time spent filling in spaces could have been better spent in other ways	Dist	0	8.9	53.3	37.8
	Int	4.7	11.3	59.4	24.5
Filling in the spaces helped with my understanding of concepts	Dist	41.3	54.3	4.3	0
	Int	38.3	53.3	8.4	0
The information I wrote in the Study Guides provided a summary which was useful for revision	Dist	44.4	46.7	4.4	2.2
	Int	46.3	49.1	4.6	0
I filled in most of the spaces in the Study Guides	Dist	50.0	43.5	2.2	4.3
	Int	28.0	57.9	12.1	1.9

Practical Work

As mentioned previously, the section of the survey dealing with practical work was different for distance and internal students; however, similar (and in two cases identical) statements were used for both groups. Responses are shown in Table 5; there is an obvious difference between distance and internal students with the former considerably more negative about their practical experience. Judging by written comments, the major reason for this is dissatisfaction with the shortening of the residential school from four to three days. This resulted in some exercises having to be rushed or shortened and a perception that the school was not well organised; on

the other hand, some students commented with pleasure on the amount of work they were able to complete during the residential school, and on the helpfulness and dedication of demonstrators. As a consequence of the 1994 experience, the residential school for Concepts of Biology will be extended to four days at Wagga and Albury in 1995.

> The res school was very rushed. I felt left behind on some days.
>
> Res school was vital in meeting other students and lecturers. Practical exercises reinforced our readings.
>
> Practical classes gave us a 'hands on experience' with the concepts we were learning. Gave us a better understanding of topics.
>
> Practical classes are necessary in this type of subject.

Table 5: Student responses to practical work

Statement	Mode	SA	A	D	SD
The residential school was well organised	Dist	15.6	44.4	31.1	8.9
Practical classes were well organised	Int	41.3	53.2	4.6	0.9
The practical exercises provided a good background and helped me understand the theory	Dist	15.6	55.6	24.4	4.4
	Int	29.4	63.3	6.4	0.9
The residential school was about the right length	Dist	2.2	37.0	34.8	26.1
Practical classes were about the right length	Int	22.4	69.2	7.5	0.9
The manual of practical exercises was clearly written and well organised	Dist	9.5	83.3	7.1	0
	Int	36.2	58.1	4.8	1.0
A residential school is not necessary in this subject	Dist	2.2	8.7	34.8	54.3
Practical classes are not necessary in this subject	Int	0	1.9	43.0	55.1

Additional Comments

The final sections invited students to describe aspects of the subject which they particularly liked, and suggest ways in which the subject could be improved in future. Many of the comments echoed points raised previously, such as enthusiastic support for the Study Guides and suggestions that the workload should be reduced. Other aspects which received favourable comments are summarised below.

> Laboratory demonstrators were very helpful
>
> Good lecturer, approachable; aspects of theory related to everyday experience; visual aids (overheads) during lectures helpful; broad and interesting range of topics.
>
> Use of video on animal tissues clarified the topic.

Suggestions for improvement were varied, and where possible have been incorporated into the 1995 version of Concepts of Biology. They are summarised below.

Replace rat dissection with video; video on animal and plant kingdoms would help.

Outline of text reading sent as early as possible to allow an early start.

Subject should be more course-specific.

Change lecture timetable; provide tutorials for difficult topics.

Some practicals were repetition of high school biology and therefore boring.

More advance information about residential school organisation; more time for discussion/tutorial sessions during residential school.

Various suggestions for changing the assessment, including: more assignments; greater weighting for practical work; less weighting for practicals; more frequent tests.

Summary

Concepts of Biology appears to have been very well received by the majority of students, both distance and internal, despite some inevitable teething problems. The 1995 cohorts will be surveyed using a slightly modified questionnaire, emphasising aspects of the subject which emerged in this survey as particular areas of concern (workload, feedback, prior knowledge etc).

While the responses to specific statements are useful for obtaining quantitative data about student reactions and opinions, it is the written comments which have proved particularly instructive in this survey. Allowing respondents to express themselves in their own words provides an opportunity to qualify their responses to bald statements provided by the survey designer, and to canvass aspects which are not included in the survey. It also appears to have had a cathartic effect on some participants - one student appended an additional two-page diatribe (mainly complaints about the residential school and lack of feedback). For the 1995 survey, the form will be modified to encourage more written comments.

Acknowledgment

The high quality of production evident in the teaching materials is due in large part to the tireless efforts of Sue Davies, then OLI Instructional Designer responsible for Concepts of Biology. Using a combination of gentle persuasion and veiled threats, she managed to extract from four busy academics the draft material for the Study Guides and then edited this material into a consistent, coherent and readable style. In some cases this involved extensive rewriting, and in all cases meticulous proofreading of several drafts. Many of the innovations in presentation and approach used in the mail package were her ideas. Sue also acted as a 'model student' reading the materials for inconsistencies and confusing explanations. It was due to her encouragement and assistance that this survey was undertaken.

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The Implementation of Modularisation in Tertiary Institutions in Australia

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Abstract

This paper presents the findings of a survey conducted to determine the extent of modularisation of distance education materials in Australian tertiary education institutions.

The survey showed that the modularisation process had been generally well received in the institutions which had adopted it, although a few disadvantages were noted. Only one respondent institution had tried the modularisation of its subjects but later abandoned it. Modularisation was found to give flexibility to students in designing their study program, and also provided the efficient use of teaching resources for both internal and external courses.

Introduction

The use of a modular unit approach to the provision of subject learning materials is well documented both as a method of facilitating learning and providing students with the flexibility to control their learning. Modularisation is spreading rapidly through teaching institutions in many countries. Modular course structures, as we know them today, first emerged in American higher education approximately a century ago.

> As has often been the case in American education, Harvard University proved the major initiating agent for change, at this point (1869) by introducing the elective system replacing fixed curricula with an increasingly wide choice of courses.
>
> (Theodossin, 1986: 5)

Britain and Scotland have been at the forefront in the use of modularisation with the Open University in Britain pioneering the modularisation of its courses since 1971. Modularisation as seen by the British educational system is a managerial response to the demands for increased cost- effectiveness, flexibility and consumer- choice in many sectors of tertiary and secondary education (Jonathan, 1987: 86). However, the widest implementation of modularisation has occurred in British secondary schools and in Scotland, in their 16+ Action Plan for post-16 education.

The Spread of Modularisation in Australia

The history of modularisation in Australia has its origins in the TAFE system which has traditionally focussed on training students for a specific vocation (Wright and Pearce, 1992: 18). The modular format has been directed at educating students who have problems or difficulties with the traditional forms of education or have found it difficult to cope with the pace of classroom learning. Modularisation is now beginning to spread to the university system, particularly as it offers a great opportunity for articulation with other courses eg. those offered by TAFE, since modularisation allows the precise identification of the relationship between one course of study and another (Pearce and Wright, 1992: 25).

The last ten years have seen great changes taking place in Australian tertiary education – there is now greater access for all students to tertiary institutions and we have a system that is more open for the prospective student. Each university is also very competitive in trying to attract student numbers. More ready access to tertiary institutions can be attributed to a number of factors, including:

- increasing numbers of students seeking entry to tertiary institutions;
- increasing diversity of entry pathways to tertiary education;
- access and equity initiatives; and,
- government pressure on the higher education sector.

The recent restructuring of the Australian University system has also been another major change that has taken place in Australian education. There are no longer just individual tertiary institutions but many multi-campus institutions. In Australia, there are now more than twenty five universities that are multi-campus institutions. For example, Charles Sturt University consists of three campuses as far afield as Wagga Wagga, Bathurst and Albury with satellite campuses at Broken Hill and Dubbo.

One of the ways of meeting the changes that are taking place in Australian tertiary institutions is the process of modularisation. Modularisation has been found to be one of the ways of meeting the needs of these changed conditions as well as providing students with greater flexibility and choice in the material they study. As there is now such a wide range of student abilities, the education system must adapt to meet their needs. As modules are 'stand alone' units of work, they can be used by students to choose modules appropriate for their learning. Modularisation also allows for the provision of bridging and enabling modules. Modularisation has thus created flexibility for students in their learning and meets the needs of today's student.

Modularisation also fits in well with the recent restructuring of the university system. With the advent of many multi campus tertiary institutions in Australia, students enrolled at one campus can now have access to specialist modules taught on another campus of the same university, or even in some cases at another university.

Modularisation at Charles Sturt University

In October 1992, the Open Learning Institute of Charles Sturt University received funding from the National Priority (Reserve Fund) to support a project to examine methods to enhance the quality of its distance education materials and make them more appropriate and accessible for use in the context of open learning. The method by which the project was to realise its primary purpose was through the modularisation of distance education materials.

A course taught at this university is defined as a prescribed sequence of subjects leading to the award of a degree and each of the subjects within the course may be comprised of modules. Modularisation is the process of breaking these subjects into smaller sections of work which exist independently of each other.

Open Learning Institute staff at Charles Sturt University defined modularisation as:

> ...a process of re-defining and re-organising subject material in order to produce sections of work each of which has recognisable boundaries, objectives, content, self-assessment, items of formal assessment and, very importantly, information on requirements- either formal or informal (prior knowledge and experience) - that are necessary to successfully complete the module. The context of the module- where it articulates with other modules and its contribution to a subject or subjects, and the course overall- is also a characteristic of a module.
>
> (Pearce and Wright, 1992: 22)

The benefits of modularisation identified by Pearce and Wright (1992: 25) are:

- facilitation of student learning through the provision of open learning materials in discrete portions;
- provision of greater flexibility of use, e.g. for non credit courses, for internal students; summer session and for supplementary examination of students;
- provision of easier articulation with other subjects e.g. between TAFE and university;
- facilitation of the development of bridging modules based on pre-requisites; and,
- aid in easier revision of subjects.

As of June 1994, a total of two hundred and forty two subjects had been modularised, out of six hundred and thirteen subjects being taught across the University.

As a result of the experiences of modularisation thus far, it is recommended that:

- all new and revised subjects be presented in modular form where possible;
- the use of common modules in several subjects be explored and encouraged and an inventory of all available modules, their content and outcomes be established;
- where feasible and appropriate, on campus students be provided with learning modules; and,
- where justified in terms of pre-existing competencies, professional needs and course coherence, students be allowed to substitute modules to meet their particular needs.

Survey of Tertiary Institutions in Australia

In order to determine whether the principles of modularisation have been implemented in universities and other tertiary institutions in Australia, a survey was undertaken. This survey sought to ascertain whether modularisation has been successful as a method of facilitating student learning. A total of 28 questionnaires was sent to tertiary institutions listed in the *Directory of tertiary external courses in Australia 1993* as providers of distance education in Australia. A total of 19 responses were received, of these nine (47%) were using modularisation for their distance education materials and ten (53%) were not using modularisation. Both OTEN (Open Training and Education Network), TAFE, NSW and the Adelaide Institute, TAFE, South Australia, offer most of their subjects in modular form. The Orange Agriculture College, University of Sydney, is currently in the process of modularising all subjects with 50% of all subjects modularised thus far. The following institutions are in the process of modularising: Southern Cross University (50%), Northern Territory University (twelve subjects); the School of Applied Science, Gippsland (forty subjects) and Monash University, (twenty subjects). By contrast other institutions, Southern Queensland University (two control units) and Macquarie University are just beginning the modularisation process to assess its viability of modularisation as an effective learning tool.

Results of the Modularisation Survey

One of the major advantages of modularisation as perceived by this survey was the flexibility that modularisation provided to facilitate student learning. This flexibility was reflected in a variety of ways. As OTEN succinctly stated the advantages of modularisation in their reply: 'Flexible learning packages can be designed to promote self pacing, use of generic modules, variety in assignment placing, recognition of prior learning and use of existing resources.' In identifying the advantages of modularisation other respondents stated that it:-

- facilitates program assessment and tightly links theory and practice in science subjects (School of Applied Science, Gippsland);
- informs students of what is expected of them. Modularisation has been accompanied by rigorous evaluation programs and hence continual improvement of learning material. Also it has seen a move to independent study (Southern Cross University);
- allows greater choice for students (University of Southern Queensland);
- clarifies objectives to be achieved by the student, what content is covered and which direction the module is taking (Northern Territory University);
- enhances efficiency and flexibility with common modules used across a variety of courses. It has provided a better use of learning resources for external and internal use (Orange Agricultural College, University of Sydney);
- assists flexible delivery and the Recognised Prior Learning process. Students can select from a wider range of electives and it is easier to tailor programs to clients needs (Adelaide Institute);
- allows students to choose the module of the subject that is applicable to their requirements. It tailors the subject/course to suit the students individual needs (OLI- Queensland); and that it
- lets the student know what is expected to be learnt since this is clearly set out and organised (Macquarie University).

Disadvantages of modularisation

Disadvantages of modularisation focussed on the fragmentation of learning that could occur when information is broken down into smaller units.

> There is a danger of de-emphasising long term integration of learning.
> (School of Applied Science, Gippsland)

> Some difficulties encountered in moving between generic and industry- specific modules- this is solvable.
> (OTEN)

Modularisation was also found to place increased demands on record keeping and administration.

> In some instances smaller assessable units of study have led to the staff being overloaded.
> (Southern Cross University)

Those institutions not using modularisation

Ten of the nineteen respondents were not using modularisation, but three institutions had begun investigating the possibility of modularising subjects while one institution requested more information concerning modularisation as they thought it was an interesting concept. Two institutions had difficulties with the interpretation of what a module was and sought additional clarification of the modularisation process. One university that had tried modularisation found this process was highly inefficient and 'generally discouraged the production of smaller modules for reasons of cost effectiveness'. This institution has elected to provide students with 'more degree of choice within the subject rather than alternative components of subjects'. They agreed with choice in subjects not between subjects.

All of the institutions participating in the survey requested more information regarding modularisation as they were interested in investigating it as a worthwhile method of meeting the needs of their students.

Conclusion

Modularisation is proving to be a practical, effective way of meeting the significant challenge due to the changes that have occurred in tertiary institutions in Australia today. Modularisation also helps to cater for the wide variety of students with differing needs and prior knowledge. Most importantly modularisation has been found to give students greater flexibility in the choice of appropriate learning material.

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Icons In Teaching Materials - Distraction Or Salvation?

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Abstract

This paper examines how students respond to the use of icons in learning materials and it is part of a broader survey which appears as paper four in this issue of *Occasional Papers in Open and Distance Learning*. The paper concludes from a study of approximately 200 questionnaires that students overwhelmingly endorse the value of icons in study materials where they have been used with discretion and their meanings have been clearly explained.

Background

An icon is a symbol or visual cue which imparts a message. The use of icons in everyday communication is widespread: road signs, commercial logos and religious symbols are examples of icons with which we are all familiar. The association between the icon and the object or idea it represents is very specific, so icons are a shorthand way of conveying information or concepts which may be quite complex and may involve several separate pieces of information. For example the Red Cross icon conveys information not only about blood donation, but also symbolises the organisation's ambulance and social welfare services. The icon does not need to provide a physical representation of the corresponding object; most parents can testify that even small children are able to associate the ubiquitous golden arches with junk food!

In teaching materials a range of visual cues may be used to assist with student learning. These include use of bold and italics, changes in fonts, enclosing text in boxes and borders, varying the layout of text, and the use of icons (Harris 1994). Icons are often used to show where particular information is located and to draw attention to tasks or activities to be carried out by the student. Figure 1 gives some examples of icon uses in distance education materials.

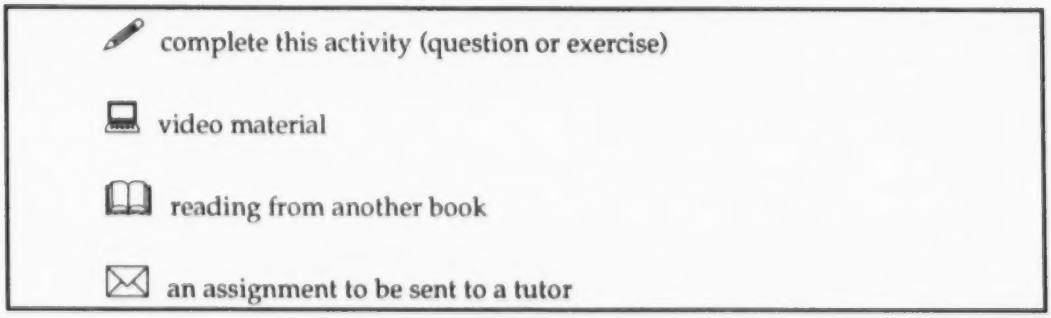
complete this activity (question or exercise)
video material
reading from another book
an assignment to be sent to a tutor

Figure 1: Typical icons and their meanings (from Rowntree 1990)

Opinions are mixed regarding the appropriateness of icons for distance education materials. According to Rowntree (1990) visual signposting is a valuable supplement to verbal signposting (the use of key words/phrases) and in particular icons can be of assistance to readers for informing them in advance of the kind of material which they are about to encounter. On the other hand Misanchuk (1992) recommends against the use of visual cues such as boxes and icons. Both authors caution that the number of icons should be limited and that they should be used with restraint. This dichotomy of opinion is reflected in the CSU OLI Style Guide which recommends that icons and boxes not be used.

Given the uncertainty about their effectiveness in distance education materials, icons were included in the Concepts of Biology mail package on a trial basis. This paper describes the results of this trial and the survey responses of students to the use of icons.

The Subject

Concepts of Biology is a first-year introductory biology subject which was offered for the first time in Autumn 1994. The teaching materials were written by a team of four lecturers drawn from all three campuses and the subject was offered by distance and internal modes at Wagga Wagga and Albury and by internal mode only at Bathurst. The student clientele for this subject is very diverse and in 1994 included students enrolled in Environmental Science, Medical Laboratory Science, Biotechnology, Parks and Recreation, Occupational Therapy and Analytical Chemistry as well as small numbers from other courses including Arts, Agriculture and Secondary Education.

The teaching materials consisted of a Subject Outline, two Study Guides and a manual of Practical Exercises. The theory component of the subject was divided into nine parts each consisting of several topics. Study Guide 1 covered the subject matter in the first half of the session (Parts 1 - 6) and Study Guide 2 dealt with topics from the second half (Parts 7 - 9). Icons were used throughout both Study Guides and care was taken that all authors used the symbols in the same way.

The icons used in the Study Guides are summarised in Figure 2.

★	You should know and understand this information **in detail**. You will be expected to have a thorough mastery of the information.
📖	The section is not examinable and you should read for interest only.
⏳	The time required for **each Topic** is indicated at the start of the notes dealing with the Topic. (The total amount of time you should spend on **each Part** is shown at the beginning of the notes with that Part.)
✎	A space has been left for you to insert a diagram or equation to illustrate a particular point; or you are to fill in the spaces in a table, label a diagram, etc.

Figure 2: Icons used in Concepts of Biology Study Guides

The 'hourglass' icon conveyed a message similar to those described by other authors (Misanchuk 1992). However the 'star' and 'book' icons were used in a somewhat different manner, in that the icons indicated the depth of understanding of the subject matter to be achieved by the student, rather than simply denoting a particular task to be completed. The 'pencil' icon was used in conjunction with a range of interactive learning tasks embedded in the text of the Study Guides.

The meaning of each icon and how they were to be used was explained (as shown in Figure 2) in the Introduction to Study Guide 1 and repeated in an abridged form at the start of Study Guide 2.

The Survey

Student reactions to the use of icons were recorded as part of a broader survey of all aspects of Concepts of Biology. All distance education students who were still enrolled in May were sent a survey form along with a reply-paid return envelope with instructions to return the survey form by the end of session. Internal students at Bathurst and Wagga Wagga were surveyed during the last two weeks of lectures; due to an oversight Albury internal students were not surveyed. A total of 99 distance and 102 internal students received survey forms.

Response rates were 46% for distance and over 90% for internal students; the figure for distance students was surprisingly good considering the usually low response rates to the standard Subject Evaluation Questionnaire, and reflects the value of having the survey process completely separate from other aspects of the subject. For internal students, the survey forms were distributed and collected during scheduled classes.

Students were asked to respond to each of five statements about icons on a four-point scale (strongly agree, agree, disagree, strongly disagree). They were also given the opportunity to provide written comments.

Survey Results

The student responses are summarised in Table 1.

Table 1: Student responses to icons

Statement	Mode	SA	A	D	SD
The meanings of icons were clearly explained so that I understood what each one meant	Dist	57.8	37.8	2.2	2.2
	Int	35.2	55.2	8.6	1.0
Icons were useful for highlighting the important points to study	Dist	57.8	37.8	4.4	0
	Int	45.1	52.9	2.8	0
I found the icons confusing and/or distracting	Dist	2.2	6.7	40.0	51.1
	Int	0	5.8	56.3	37.9
The location of icons in the page margins was appropriate	Dist	44.4	53.3	2.2	0
	Int	25.2	72.8	1.9	0
I would like to see icons in other subjects I study in future	Dist	61.4	38.6	0	0
	Int	44.1	52.0	3.9	0

In every case the agreement rate (disagreement rate for statement 3) was in excess of 90% which demonstrates conclusively that icons are fulfilling a valuable role in Concepts of Biology. Written comments (see below) bear this out.

Distance students were consistently more positive in their responses than were internal students, as might be expected since the latter students have regular access to lecturers and are consequently less dependent on the icons as a major source of instructions for study.

Comments

On the whole students were overwhelmingly positive about icons. Comments included 'great', 'more icons the better', 'user friendly', 'icons were a great help', 'very important', 'a good idea'. In general students reported the following benefits:

(a) Icons served as a filtering device by highlighting the points students were required to focus on and those which could be browsed or omitted;

(b) Icons were useful in planning time allocation, giving a good indication of how study time should be divided between topics;

(c) Icons helped when studying for exams; important revision points were easy to find.

Only two criticisms of icons were mentioned, interestingly both by distance students - it is reasonable to suppose that any problems with icons will have more severe effects on students who are more dependent on them. The first problem was a degree of confusion about how much of the Study Guide text was referred to by each icon; there was uncertainty whether an icon referred to a single paragraph or all the following text until the next icon. This problem has been addressed in the 1995 edition of the Study Guides by introducing a 'stop' icon (a small square) to indicate the end of a section referred to by a 'star' icon. The second criticism pointed to occasional inconsistencies in the use of icons (for example, aspects which were emphasised as important in the text of the Study Guide but did not have a 'star' icon). Once again the 1995 edition has eliminated this source of uncertainty.

Conclusion

The consistently positive responses to the use of icons in the Concepts of Biology study materials suggest that a blanket veto on their use in teaching materials is an overreaction to the adverse comments of some authors. It may be that the negative attitudes to icons in some quarters have arisen because of careless or profligate use, which would serve to confuse rather than enlighten and assist. In this case, only four icons were used and their meanings were clearly explained right from the start. The problems which students identified were easily solved; however, they show how careful one has to be when using icons in teaching materials.

Icons are widely used in computer software to increase efficiency by reducing the keystrokes necessary to access a particular application. As more and more people

become accustomed to icon-driven computer programs, the use of icons in teaching materials will probably cease to be an issue.

The results of this survey were conclusive: when used sensibly, icons are powerful tools to assist students cope with teaching materials. Students like icons, find them useful and want to see them more widely used. It is up to us to fulfil their wishes.

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